

BETWEEN

HER MAJESTY THE QUEEN in right of
Alberta, as represented by the Minister of
Sustainable Resource Development
(the "Province")

- and -

(the "Contractor")

BACKGROUND

The Province wishes to obtain the services of certain rotor wing aircraft complete with operators for the conduct of the operations; and

The Contractor is ready, willing and able to supply the rotor wing aircraft for the exclusive use of the Province in the conduct of the operations, on the terms and conditions hereinafter set forth;

Therefore in consideration of the premises and covenants in this Agreement the parties agree as follows:

DEFINITIONS

1.
 - (1) In this Agreement:
 - (a) "Agreement" means this document and the written materials as specified below in sub-section (3).
 - (b) "aircraft" or "rotor wing aircraft" means a rotor wing aircraft that is described in Schedule "A" of this Agreement or that is supplied by the Contractor in replacement for the rotor wing aircraft;
 - (c) "availability day" means each day or portion thereof in which the Province requires the aircraft, pilot or engineer to be immediately available and airborne within a designated period;
 - (d) "density altitude" means a given block of air (or atmosphere) with a measured pressure and temperature translated to an "altitude above sea level for use in

figuring its capability to support aircraft in flight". This is referred to as density/altitude calculations for this contract;

- (e) "Engineer" means any Engineer assigned by the Contractor to maintain and repair the rotor wing aircraft and includes any substitute or relief Engineer so assigned;
- (f) "FOIP Act" means the *Freedom of Information and Protection of Privacy Act* (Alberta), as amended from time to time;
- (g) "foam injection system" means a system used for dispensing foam into a helicopter bucket.
- (h) "Materials" means any work, information, records or materials, regardless of form, which are made, generated, produced or acquired by the Contractor or its employees, subcontractors or agents in the course of performing the Services;
- (i) "Minister" includes a Deputy Minister of the Minister or any person authorized by the Minister or a Deputy Minister to act on behalf of the Province for the purpose of this Agreement;
- (j) "PFFC" means the Provincial Forest Fire Centre, located in Edmonton, Alberta;
- (k) "Personal Information" means personal information as defined in the *FOIP Act*;
- (l) "operations" means work pursuant to this Agreement for which the Province from time to time requires the rotor wing aircraft to be available, or to which it is from time to time assigned by the Province within the Province of Alberta and in areas of Saskatchewan, British Columbia, Yukon and the Northwest Territories that are adjacent to Alberta, as entered into by Border Zone Agreement with their Governments or elsewhere in Canada and the USA as may be required under Alberta participation under the Mutual Aid Resources Sharing (MARS) Agreement and the Canada/US Reciprocal Forest Firefighting Agreement (CANUS).
- (m) "Pilot" means any Pilot assigned by the Contractor to the rotor wing aircraft and includes any substitute or relief Pilot so assigned; and
- (n) "Rapattack" means initial attack on forest wildfires involving the use of specially trained, mobile helicopter rappel crews. These crews are a pre-equipped, self-contained resource, committed to firefighting for the duration of the fire season;
- (o) "Services" means the work, duties, functions and deliverables described in Schedule A; and
- (p) "T.C." means Transport Canada or any employee of the Crown in right of Canada who works in the Department of Transport and who is authorized, expressly or impliedly, to act on behalf of the Minister of Transport in relation to any of the matters dealt with in this Agreement;
- (q) "Pilot" means any Pilot assigned by the Contractor to the rotor wing aircraft and

includes any substitute or relief Pilot so assigned; and

- (2) In this Agreement and the Schedules, words importing the singular include the plural and vice versa; words importing male persons include female persons and vice versa; and words importing persons include firms and corporations.
- (3) The following, and the terms, conditions, and provisions therein, form and constitute an integral part of this Agreement:
 - Schedule "A" – Rotor Wing Specifications, Personnel and Payment,
 - Schedule "B" – Aircrew Qualifications
 - Schedule "C" – Paint Schemes
 - Schedule "D" – Rapattack Rappel Pilot Qualification
 - Schedule "E" – Designation of Prime Contractor (*if applicable*)
 - Schedule "F" – Flight Manual Supplement and,
 - Schedule "G" – Seating Arrangements
 - Schedule "H" – Load Analysis
 - Schedule "I" – Substitute Aircraft
 - Schedule "J" – Aircrew Subsistence Rates

TERM

2. (1) The Contractor shall supply to the Province, one (1) medium rotor wing aircraft owned or leased by the Contractor, as described in Schedule "A", in good working condition, and in respect of which there is in force and effect a Certificate of Airworthiness issued by T.C., for a period of 100 days each year (such period sometimes hereinafter referred to as the "core period"), commencing April 1, 2012 and ending March 31, 2017. In addition to the 100 core contract days, the aircraft shall be made available for 4 training days; sometime between April 1 and the date preceding commencement of core period of each year. Payment structure of the training days is referred to in Section 26(1). This Agreement shall, subject to its earlier termination, be in force and effect from the date of execution of this Agreement until March 31, 2017.
- (2) In the event that the supplied aircraft is not serviceable for an extended period of time the Province may require the Contractor to substitute the aircraft with an aircraft as listed in Schedule H which meets all the requirements of Schedule A. All expenses to move substitute aircraft shall be at the expense of the Contractor.
- (3) The Contractor hereby agrees that it will make the aircraft available during any further periods of renewal as determined by the Province. Upon this Agreement being renewed, it shall be considered to be amended so as to incorporate all of the terms of the renewal, including the further period of the charter which shall be considered to be substituted for the period of exclusive use specified in section 2(1).
- (4) The Province may, during 2012, unilaterally and as sole judge for the purpose extend, vary or modify the period for which it requires the exclusive use of the aircraft during the year. The period during any year of this Agreement for which the Province requires exclusive use of the aircraft and any extension, variation or modification by the Province of that period is hereinafter referred to as "the period of the charter".

- (5) In the event that the Province requires medium rotor wing aircraft for the purposes of wildfire prior to or after the aircraft has completed its core contract, the Province may wish to hire the aircraft if it is available under this contract at the Pre and Post Season Extension rates as described in Schedule A.

TERMINATION

3. (1) The Province may at any time immediately terminate this Agreement, without cause, upon written notice to the Contractor. If this Agreement is terminated:
- (a) all Materials made, prepared, developed, generated, produced or acquired by the Contractor, or its employees, subcontractors or agents under this Agreement are the property of the Province; and
 - (b) the Province shall only have to pay the Contractor for the Services completed in accordance with this Agreement up to the effective date of termination.

PERFORMANCE GUARANTEE

5. (1) On the execution of this Agreement and on April 1st of every core period of the Agreement is in effect, the Contractor shall at its own expense provide a money order, bank draft, certified cheque, performance bond or irrevocable letter of credit in a form and with carriers satisfactory to the Province in the amount of 15% of the total charge during that year, for the daily standby charges and the guaranteed core period as listed in section 2(1); as a guarantee and security for the due and faithful performance of the Agreement by the Contractor and to protect the Province against any loss or damage arising by reason of the acts and omissions of the Contractor. The Province shall not pay interest on any such guarantee and security.
- (2) Any bid deposit or letter of credit accompanying the bid or tender submitted by the Contractor in this matter may be held and applied by the Province as further guarantee and security for the due performance of the Agreement by the Contractor, in addition to the money order, bank draft, certified cheque, performance bond or irrevocable letter of credit referred to in subsection (1).
- (3) Any performance bond or letter of credit shall name as obligee or beneficiary the Minister of Finance of Alberta and must be issued by a chartered bank, the Province of Alberta Treasury Branch, or a credit union (in the case of a performance bond, must be issued by a commercial bonding or insurance Contractor licensed in Alberta). The performance bond or letter of credit shall, in any event be irrevocable, unconditional and be in a form, content and effective term satisfactory to the Province. A certified cheque must be payable to the Minister of Finance of Alberta and must be certified by the chartered bank, the Province of Alberta Treasury Branch or credit union upon which the cheque is drawn.
- (4) In addition to and without restricting the rights of the Province given elsewhere in this Agreement, it is expressly agreed that upon any default or failure of the Contractor to perform this Agreement, the Province shall be entitled to realize, enforce, and call upon the guarantee and security in such amount or amounts as the Province determines appropriate, in the manner appropriate to the form of guarantee and security, and such amount shall be forfeit to the Province. Such realization shall be in addition to any other remedies available to the Province.

- (5) If at any time the Province is unable to obtain official clearance from the Alberta Workers' Compensation Board (WCB) for and in respect of fees, premiums and assessments that are or may become payable by the Contractor to WCB relating to the Contractor's performance of the services of this Agreement:
- (a) the Province shall be entitled to, and may at its sole option withhold sufficient amounts of monies earned by the Contractor to cover the potential WCB claim and remit to WCB from the Contractor's earnings such amount as WCB claims;
 - (b) if the Province does not hold a sufficient part of the amounts earned by the Contractor under this Agreement to fully pay and satisfy actual or potential WCB claims (hereinafter called the "WCB Claim"), the Province shall also be entitled to realize on the guarantee and security for due performance, according to the type of guarantee and security, by declaring that the cash, certified cheque or other security is forfeited to the Province, or enforce and call upon the performance bond surety or guarantor of the irrevocable letter of credit to honour their performance bond or letter of credit, as the case may be and the proceeds of the performance guarantee shall be used to satisfy the WCB Claim to the extent that the Province has legal liability in respect of the WCB claim; and
 - (c) the Province may call on any performance guarantee or security of any kind held by it when it determines in its sole discretion that the Contractor has breached this Agreement or is otherwise indebted or obliged to the Province.

STATUTORY COMPLIANCE AND OCCUPATIONAL HEALTH AND SAFETY

6. (1) The Contractor and its employees and agents shall comply with the provisions of:

- (a) the Aeronautics Act (Canada), the Transportation Act (Canada), the Occupational Health and Safety Act (Alberta) and the Alberta Workers' Compensation Act, in force or enacted from time to time, as amended from time to time, and
- (b) any other Act of the Legislature of Alberta or of the Parliament of Canada, in force or enacted from time to time, as amended from time to time, and
- (c) regulations, orders or other subordinate legislation from time to time made under any of the Acts referred to in clause (a) or (b), and any amendments to or substitutions of these regulations,

to the extent that any of the aforesaid are applicable to the Contractor or to the services under this Agreement, whether specifically or generally and whether by express wording or implication. The Contractor agrees that, except as in noted hereinafter, it shall apply for and obtain any license, permit, approval or other consent required pursuant to any of the foregoing, and any fee, levy, tax, or costs payable in respect thereto shall be paid for by the Contractor at its own expense.

- (2)
 - (a) The Contractor shall inform itself, and cause its employees to inform themselves, as to their respective legal responsibilities under the *Occupational Health and Safety Act*, Regulation and Code.
 - (b) If the Contractor is designated as "Prime Contractor" as per Schedule "E" - Designation of Prime Contractor, the Prime Contractor shall ensure as far as it is reasonable practicable to do so, that the *Occupational Health and Safety Act* and Regulations are complied with in respect of the work site.

(3) Prior to performance of the services in this Agreement the Contractor shall submit to the Province:

- (1) a copy of a valid "Certificate of Recognition" or equivalent or an OH&S program outlining this system or process.
- (2) a written safety plan. The safety plan shall address; the hazards of the services to be performed under this Agreement, the control measures that shall be implemented to eliminate or reduce the risks of the hazards to a reasonable level, the first aid/medical services and measures that shall be activated in event of an emergency. For other hazards identified during the performance of the Agreement the Province may also request that safety plans be provided.
- (5) All safety plans will be reviewed by the Province before work proceeds. The Province reserves the right to review documents and monitor the Contractor's compliance to the safety plan. Review of the safety plan and monitoring for compliance does not relieve the Contractor of his responsibilities as defined in the *Occupational Health and Safety Act* and regulations of those assigned by this Agreement.
- (6) The Contractor shall immediately report to the Province all work related accidents resulting in medical aid, disabling injury or fatality and serious accidents (defined in section 18 of the *Occupational Health and Safety Act*) occurring as a result of any services provided under this contract. The Contractor shall further ensure that, where required by statute or regulations, accidents shall be reported to the Alberta Workers' Compensation Board, Alberta Employment and Immigration as well as Transport Canada.
- (7) Where the Province determines and notifies the Contractor that work does not comply with the *Occupational Health and Safety Act* and Regulations or the safety plan, that work will be suspended. That work will not resume until corrective actions have been taken to the satisfaction of the Province. The Province shall consider a breach of the *Occupational Health and Safety Act*, Regulation, Code or safety plan a breach of this Agreement.
- (8) When the *Workers' Compensation Act* (Alberta) applies, and upon request from the Province, deliver to the Province a certificate from the Workers' Compensation Board showing that the Contractor is registered and in good standing with the Board. If a director or owner of the Contractor will be performing work on site where the Province is the Prime Contractor, the owner or director shall have personal coverage from the Board in effect.

INSURANCE AND HOLD HARMLESS

6. (1) The Company shall, at its sole cost and expense, and without limiting its liabilities provide and maintain in full force and effect during the term of this Agreement, with an insurer licensed in Alberta, a policy of Aircraft Insurance on all aircraft to be used by the Company in the operations consisting of:
 - (a) aircraft hull insurance, insuring against loss of or damage to the aircraft, and against all risks, ground and flight, in an amount not less than its market value, and

- (b) aircraft liability insurance in an amount not less than \$5,000,000 per occurrence, including passenger hazard liability where applicable.

(2) The policy of Aircraft Insurance shall contain endorsements whereby the insurer:

- (a) undertakes to notify the Province in writing at least 30 days in advance of cancellation of the policy or material change restricting coverage,
- (b) acknowledges that the aircraft may engage in deliberate low flying as required for the conduct of the operations without invalidating coverage under the policy,
- (c) includes a waiver of subrogation in favor of the Province to the aircraft hull insurance;
- (d) includes Her Majesty the Queen in right of Alberta as represented by the Minister of Sustainable Resource Development as an insured to the liability insurance,
- (e) includes a cross liability and severability of interests endorsement; and
- (f) includes a Contractual Liability Endorsement.

(3) Comprehensive or Commercial General Liability, in an amount not less than \$2,000,000.00 per occurrence, insuring against bodily injury, personal injury and property damage including loss of use thereof. Such insurance shall include:

- (a) Products and Completed Operations Liability;
- (b) Owner's and Contractor's Protective Liability;
- (c) Blanket Contractual Liability;
- (d) Contingent Employer's Liability;
- (e) Non-Owned Automobile Liability
- (f) Cross Liability with respect to additional insureds;
- (g) Employees as additional insureds;
- (h) Broad Form Property Damage Endorsement;

and where such further risk exists:

- (i) Operation of Attached Machinery.

(4) Automobile Liability on all vehicles owned, operated or licensed in the name of the Company, in an amount not less than \$1,000,000.

7. Before commencing the operations under this Agreement, the Company shall supply to the Province, either:

- (1) a certified true copy of the policy of aircraft insurance in a form and having a content satisfactory to the Province, that conforms in all respects to section 6 and signed by an authorized agent of the insurer, or
- (2) a Certificate of Insurance in a form and having a content satisfactory to the Province, fully describing coverage provided by the policy that conforms in all respects to section 6 and signed by an authorized agent of the insurer.

HOLD HARMLESS

8.

- (1) Each party shall indemnify and hold harmless the other party, the other party's employees and agents from any third party claims, demands, actions or costs, including legal costs on a solicitor-client basis, for which it is legally responsible, including those arising out of negligence or wilful acts by the responsible party, its employees or agents. This hold harmless provision shall survive this Agreement.
- (2) Subject to the above indemnity neither party shall be liable to the other in connection with any claim for any special, incidental, indirect or consequential loss or damage.
- (3) The Contractor shall indemnify and hold harmless the Province against and from any loss or damage to the real or personal property of the Province for which the Contractor is legally responsible arising from or relating to the performance of Services or any other obligation of the Contractor under this Agreement.

PERSONNEL

10. (1) The Contractor at all times and at its own expense, shall provide personnel for the rotor wing aircraft as described in, and conforming to the requirements of, Schedule "A" and shall for each of those personnel who, for any reason whatsoever, is unable to perform his duties, provide at its own expense a substitute who is satisfactory to the Province so that the position occupied by that personnel is always filled. The Contractor shall not engage any substitute or additional personnel in respect of an aircraft unless the Province has approved the substitution or addition and the qualifications of the substitute or additional personnel. If the Contractor intends a substitution for, or an addition to, the personnel of a rotor wing aircraft, the Contractor shall provide to the Province full particulars of the qualifications of the substitute or additional personnel. The Contractor shall allow a one day overlap on pilot exchanges where the replacement pilot has not been certified to fly rappel operations within the previous sixty days, to allow the Rapattack Co-ordinators to certify the replacement pilot.
- (2) The Contractor shall also provide the aircraft maintenance crew that is necessary to service and maintain the aircraft in a manner that will enable it to carry out the operations satisfactorily.
11. (1) The Province may require the Contractor to do any or both of the following:
 - (a) to employ a substitute or replacement for any member of the aircrew or maintenance crew who, in the Province's opinion, is unsatisfactory for the rotor wing aircraft for safety or other reasons;
 - (b) to "double crew" the rotor wing aircraft if the aircraft is being flown continuously for a considerable number of hours. Double crewed aircraft will be compensated at the rates listed in Schedule A of this Agreement;
 - (c) to remove from the operations any aircrew or maintenance crew that, in the Province's opinion, is unsatisfactory for the operations for safety or other reasons. If the Province removes a crew or replaces a crew member under this section, the aircraft involved shall not engage in the operations until a replacement crew or substitute for the crew member satisfactory to the Province has been assigned to the aircraft.
- (2) Substitute and additional crew members who are pilots or engineers shall have the

qualifications specified for pilots and engineers in Schedule "A".

- (3) The Province may, in writing waive any of the qualifications stipulated for crew members in Schedule "A", other than qualifications prescribed by the Statutes and Regulations of Canada, in respect of all or certain specified crew members and for any period that the Province considers appropriate.
- 12.
- (1) The Contractor agrees that each pilot assigned by the Contractor to the rotor wing aircraft shall, prior to the commencement of the period of the contract, attend a three day seminar in or around Hinton, Alberta consisting of one day orientation, policy and procedures briefing, plus two days approval and certification by the Province for the operation of the rappel system in accordance with Schedule "D".
 - (2) The Contractor shall be responsible for and at its own expense pay expenses incurred for accommodation by crew members while participating in the courses and seminars described in this section. The Contractor shall also be responsible for and at its own expense pay the wages and salaries of all crewmembers while they are participating in the courses and seminars described in this section. The Province will not provide reimbursement for the expenses referred to in this subsection.
 - (3) The Contractor shall, upon request of the Province, supply a rotor wing aircraft for training purposes at the annual rappel training course held in or around Hinton, Alberta. While this Agreement or any renewal of this Agreement is in effect, the rotor wing aircraft shall be supplied for that purpose at the core daily standby rate specified in Schedule "A".
 - (4) The Contractor agrees that it and its personnel, when using government premises shall comply with all security policies, procedures, and regulations in effect from time to time at such premises.
 - (5) The crew may be boarded and lodged in semi-permanent buildings, trailer camps or under canvas. If food and lodging are provided to employees of the Province in a camp in the vicinity of the operations, the crew of the rotor wing aircraft shall board and lodge with the employees of the Province.

OPERATIONS

13.
 - (1) The Contractor and its personnel shall at all times during the continuance of this Agreement carry out, observe and abide by the directions of the Province with respect to the operations.
 - (2) The Contractor may use the rotor wing aircraft for purposes other than the operations, only with the prior consent of the Province.
14.
 - (1) The Contractor agrees, during the continuance of this Agreement, to comply with all of the terms and conditions of the licence issued to it in respect of the rotor wing aircraft by Transport Canada and to take all action required to maintain the licence in full force and effect.
 - (2) The Contractor shall, during the continuance of this Agreement, comply with all requirements of Transport Canada relating to the operation and maintenance of the aircraft.

- (3) The Contractor shall, in accordance with Section 722.19 of the Canadian Aviation Regulations, ensure their Air Operator Certificate authorizes a person to enter or leave a helicopter in flight.
- 15. (1) The aircraft supplied under this Agreement shall be available for inspection at 1500 hours on the day prior to commencement of training as outlined in section 2(1) of this Agreement.
- (2) The pilot in command will ensure that the engine or engines of any aircraft shall not be:
 - (a) started unless the pilot's seat is occupied by a person competent to control the aircraft or unless the aircraft is prevented from moving forward; or
 - (b) left running unless the pilot's seat is occupied by a person competent to control the aircraft.
- 16. When the aircraft is or is to be engaged in the operations, the Contractor shall have the aircraft airborne within the time stipulated by the Province, subject only to normal procedure and maintenance requirements.
- 17. (1) The Contractor shall, during any period when the aircraft is not engaged in the operations, carry out the routine repairs, inspection and maintenance that are necessary to keep the aircraft in airworthy condition.
- (2) If the rotor wing aircraft requires servicing or inspection of an extent or degree that cannot be accommodated by periodic servicing under subsection (1):
 - (a) the Contractor shall immediately so inform the Province and advise the Province of the estimated period of time during which the aircraft will be unavailable for the operations; and
 - (b) if the Province is of the opinion that the aircraft should be replaced, the Contractor shall immediately provide for conduct of the operations for the Province, a replacement aircraft that is:
 - (i) equivalent in model and capacity to the aircraft being replaced; and
 - (ii) acceptable to the Province.
- (3) For a replacement aircraft that meets the terms and conditions of subsection (2) above, the charge for the replacement shall be the same as that which was applicable to the aircraft originally chartered.
- (4) When the maximum payload of the aircraft that the Contractor proposes to substitute is smaller than the maximum payload of the original aircraft chartered, and if the Province, while under no obligation to do so, in its sole discretion decides to accept the use of that proposed substituted aircraft in place of the original aircraft chartered, charges for the substituted aircraft will be based on the Contractor's rates and charges applicable to the type of substituted aircraft, except that where such rates and charges are higher than those for the original aircraft chartered, the rates and charges for the original aircraft chartered will apply and paid at the rates listed in section 4(1) of Schedule A.
- (5) Notwithstanding anything in this Agreement, the Province shall without liability, be

entitled to reject or withhold approval for the use of any aircraft in substitution for the original aircraft that was to be provided by the Contractor.

18. (1) The Province shall be entitled to, at its discretion and for such period as the Province may determine, release the Contractor from carrying out the services in Alberta, and direct the Contractor to provide the services in and for, and subject to the discretion and control of, the government of another province, or territory, or the Government of Canada, or other party (any or all of the aforesaid herein called "third party").
- (2) If pursuant to subsection (1), the Contractor is directed to supply services to a third party, the following conditions will apply:
 - (a) the period during which the rotor wing aircraft is so released shall be calculated on a full day basis;
 - (b) days in which the Contractor provides services to the other government territory or third party pursuant to the release, shall be included in the count for the purpose of determining whether a number of days specified in section 2(1) has been attained;
 - (c) the rates, terms and conditions set out in this Agreement shall apply in respect of the operations conducted on special reassignment pursuant to this section unless the Province otherwise specifies in writing;
 - (d) in addition the Contractor will be given full reimbursement for the extra costs if those costs are incurred solely by reason of and directly attributable to the location of the special assignment being out of Alberta:
 - i) costs for shipping parts from Alberta to the place of special assignment;
 - ii) out-of-province crew travel costs necessarily incurred for the operations;
 - iii) fuel costs for transit to and from Alberta if incurred and paid for by the Contractor; and
 - iv) other extra-operational costs as the Province in its sole discretion agrees to pay.
 - (e) all payments will be through the Province.
19. If the Province determines that a forest fire risk exists in any area or if forest firefighting is in progress in any area, the Contractor shall do the routine maintenance, inspection and repairs described in section 17(1) during night hours only.
20. The pilot in charge of the rotor wing aircraft shall make the final decision on the following:
 - (a) the safety of a proposed flight;
 - (b) the composition, weight and storage of cargo,
 - (c) density altitude, load calculations shall be done each day, the location to be used for the calculations shall be the site that is most restrictive for the density altitude calculation due to a combination of gross aircraft weight, air temperature and altitude;
 - (d) the suitability of weather for flying the aircraft;
 - (e) the altitudes and speeds at which the aircraft is to be flown;
21. The Contractor and its employees shall not fly or attempt to fly any aircraft unless:

- (a) the weight of the aircraft and its load is less than the maximum permissible weight specified in the certificate of airworthiness or flight permit;
 - (b) the load is properly dispersed in accordance with the conditions of the certificate of airworthiness or flight permit;
 - (c) the equipment and any cargo carried are secured so as to prevent shifting in flight and are not so placed as to block or restrict the exit of passengers in an emergency;
 - (d) the required emergency equipment is carried on board and is in good condition;
22. The Contractor shall, on each day during the operations, record on an Alberta Government Flight Report Form AO-02 supplied by the Province, the particulars of all flights made during that day by the aircraft. This shall include, but is not limited to, hours flown during that day by the aircraft, and the volume of fuel acquired from the Province for the aircraft during that day and details relating to aircrew expenses. The Company shall submit the AO-02 to the Province for certification and approval at the conclusion of each flight day. No other flight source document shall be considered for payment.
23. All costs for shipment of replacement parts or miscellaneous equipment directly to the rotor wing location shall be borne by the Contractor.
24. During the period of the operations, the Contractor shall supply the vehicle(s) required to carry out the services of the Agreement and to move the Contractor's crew between their place of lodging and the site of the operations.
25. During the period of the operations, the Contractor shall supply the aircrew with a means of province-wide communication (cellular phone or pager), at no additional cost to the Province. The communication shall be adequate to ensure all aircrew meet assigned alert status.

PAYMENT

26. (1) When the aircraft is requested to be onsite for training days as outlined in section 2 (1), the aircraft will be paid in the following manner:
- (a) The Province will notify the Contractor with a tentative schedule of when the aircraft is required to be on site for training days by April 1st of each year. This schedule is subject to change and may be adjusted.
 - (b) The Core Period Daily Standby Fee, Hourly Flying Rate, and per diems will be paid accordingly for the four (4) training days as per Schedule A 4 (1)
 - (c) In the event that the training days occur over more than four (4) consecutive days the Province will only pay per diems on the non-scheduled days. During the time that the aircraft is not scheduled for training days and the aircraft is still positioned at the training area, the Province will not pay Daily Standby Rate. If there are more than 4 scheduled days off between training days the Province will only pay the per diems on the days immediately before and immediately for when the pilot(s) and engineer(2) are on site
 - (d) In the event that weather forces the Province to delay training days, only per diems will be paid on those days. No day Daily Standby Fee will be paid.
 - (e) In total there will be no more than (4) training days per contract year, April 1 to March 31.
 - (f) The contractor is free to use the aircraft for other and only scheduled training days are for exclusive use
 - (g) In the event the scheduled training days are rescheduled and these new dates conflict with other commitments which the contractor has for the aircraft and the

four training days are not fulfilled, the Province will not be held liable for the unused training days.

- (2) Subject to and in accordance with this Agreement, including Schedule "A", the Contractor shall submit to the Province, on or about the 15th and 30th day of each month of the operations, invoices for charges for use of the rotor wing aircraft for the immediately preceding period of the operations, including all approved AO-02 documents in respect of the following:
 - (a) the time during which the rotor wing aircraft was engaged in the operations, including charges for hours of flying and charges for daily standby;
 - (b) fuel purchased and consumed for the conduct of its operations;
 - (c) the expense necessarily incurred during the operations to board, lodge and transport the crews of the aircraft at the places or locations designated in accordance with the current Forest Protection Division Aircrew Subsistence Rates attached as Schedule "I";
 - (d) landing and parking fees incurred on behalf of the Province; and
 - (e) other charges approved by the Province.
- (3) Subject to and in accordance with this Agreement, including Schedule "A", the Province shall pay for the services rendered by the Contractor at the rates provided for in this Agreement.
- (4) The Contractor shall, at its own expense and without recourse against the Province, bear, pay and be responsible for any and all taxes, excise and charges of a like nature that may be imposed on the sale, transfer or provision to the Province of the services or on any goods used or provided in connection with or as part of the services.
- (5) The Province represents and warrants that, as the purchaser of the Services provided under this Agreement, no amount payable under this Agreement is subject to the Goods and Services Tax (GST) or Harmonized Sales Tax (HST) under Part IX of the *Excise Tax Act (Canada)* as amended. The Government of Alberta's GST Registration Number is 1240 72513 RT0001.
- (6) The Contractor shall pay all expenses associated with the operations, except those expenses for which the Province is made expressly responsible pursuant to this Agreement. Without limiting the generality of the foregoing, the Contractor shall pay the following expenses in connection with the operations:
 - (a) cell phone and/or pagers, including all long distance toll charges;
 - (b) crew laundry and dry cleaning;
 - (c) ground and air transport for parts, repair, personnel and crew changes
- (7) Payment of any invoice submitted under subsection (1) shall be conditional upon the Province's review and approval of the invoice.
- (8) The Contractor shall:
 - (a) keep and maintain in accordance with Canadian generally accepted accounting principles complete and accurate books, records and accounts relating to this Agreement and, on demand, provide to the Province these documents to examine, audit and make copies and take extracts; and

- (b) keep the documents referred to in clause 8 (a) for three years following the completion or termination of this Agreement.

PARTIES' REPRESENTATIVES

27.

- (1) The Province designates [REDACTED] of the Province as the Province's representative for communications and ongoing contact between the Province and the Contractor in matters relating to this Agreement, other than giving notice pursuant to clause 28.
- (2) The Contractor designates [REDACTED] as the Contractor's representative for communications and ongoing contact between the Province and the Contractor in matters relating to this Agreement, other than giving notice pursuant to clause 28.
- (3) Either party may change its designated representative above by sending written notice to the other party of such change.

NOTICES

28.

- (1) Any notice to be made under this Agreement is to be made in writing, and is effective when delivered to the address, e-mailed or transmitted by fax to the fax number, as follows:

The Province:

Address:

Attention:

Telephone:

E-Mail:

Fax:

The Contractor:

Address:

Attention:

Telephone:

E-Mail:

Fax:

The parties respectively designate for the time being, the individuals identified in this clause as having the authority to give notice, and notice given by these individuals is binding on the party giving the notice.

- (2) Either party may change its information in clause 27 by giving notice to the other in the manner described in 28 (1).
- (3) Any notice personally served, e-mailed or sent by fax shall be deemed received when actually delivered or received, if delivery, e-mail or fax transmission is on a Business Day, or if not on a Business Day, on the following Business Day.

FREEDOM OF INFORMATION AND PROTECTION OF PRIVACY

29.

- (1) The Contractor acknowledges that this Agreement, including without limitation the name of the Contractor, fees payable, the Term, and details of the Services may be subject to disclosure under the *FOIP Act*. The Contractor further acknowledges that the *FOIP Act* applies to the Province's Information collected, used or disclosed in the performance of Services, and the Contractor shall adhere to the *FOIP Act* in its collection, use and disclosure of any Personal Information.
- (2) The Contractor shall not collect, use or disclose any Personal Information under this Agreement except as reasonably required to fulfill its obligations under this Agreement, or as otherwise expressly authorized in writing by the Province.
- (3) Upon request, the Contractor shall provide to the Province, within five Business Days, any records that are requested under the access provisions of the *FOIP Act* that are in the custody or under the control of the Contractor. Should the Contractor receive an access request under the *FOIP Act*, the Contractor shall not respond to it, but shall immediately forward the access request to the Province for further handling.
- (4) In providing the Services, the Contractor shall make every reasonable effort to ensure that Personal Information that is to be or is actually used to make a decision that directly affects an individual, is both complete and accurate. At the Province's request, the Contractor must correct, within five Business Days of the request, Personal Information that the Contractor may have either collected or compiled about an individual pursuant to this Agreement.
- (5) The Contractor shall store only in Canada all records of Personal Information which are disclosed to the Contractor under this Agreement, including records that are collected, used or stored on behalf of the Province.
- (6) The Contractor shall act on any direction that the Province may provide with regard to the use, collection, access, security, disclosure and destruction of the Personal Information.

PROPERTY AND CONFIDENTIALITY

30. Ownership of all Materials including any associated copyright, patent, trade secret, industrial design or trade mark rights belongs to the Province as they are made, prepared, developed, generated, produced or acquired under this Agreement. The Materials shall be delivered to the Province upon completion or termination of this Agreement, or upon request of the Province.
- (1) Ownership of any work, information, records or materials, regardless of form, including copyright, patent, industrial design or trademark which was owned by the Province, the Contractor or a third party prior to the effective date of this Agreement remain the property of each party respectively.
 - (2) The Contractor
 - (a) irrevocably waives in whole all moral rights, and
 - (b) shall ensure that its employees, subcontractors and agents irrevocably waive in whole all moral rights, in and to the Materials in favour of the Province and the Province's assignees and licensees. Upon request of the Province, the Contractor shall deliver to the Province copies of the waivers obtained from its employees, subcontractors and agents engaged in providing the Services.
 - (3) Prior to reproducing or incorporating any third party copyright materials into Materials, the Contractor must obtain written permission from the copyright holder and provide the Province with copies of the written permissions that are satisfactory to the Province.
 - (4) The Contractor shall cooperate with the Province in protecting the Province's ownership or intellectual property rights in the Materials.

SURVIVAL OF TERMS

31. Notwithstanding any other section of this Agreement, the parties agree that this section and the following sections shall survive the expiry or the termination of this Agreement, as the case may be, and shall continue to be binding on the Contractor until their terms have been fully met:
- (a) Section 3 Termination
 - (b) Section 5 Performance Guarantees
 - (c) Section 8 Hold Harmless and Indemnity
 - (a) Section 27 Records
 - (b) Section 29 Freedom of Information
 - (c) Section 39 Property and Confidentiality
 - (d) Any other sections which expressly or by implication are intended to survive expiry or termination of this Agreement.

GENERAL

32. In the case of conflicts or discrepancies among this document and the Schedules and any Schedules attached to this document, the documents shall take precedence and govern in the following order:
 - (1) the body of this document, and
 - (2) the Schedules to this document.
33. The Contractor, its employees, subcontractors and agents when using any of the Province's buildings, premises, equipment, hardware or software shall comply with all safety and security policies, regulations or directives relating to those buildings, premises, equipment, hardware or software.
34. The Province may, from time to time, waive the performance by the Contractor of any provision of this Agreement, either before or after that performance is done, but a waiver
 - (1) is not effective or binding upon the Province, unless it is in writing signed by the Province or under its authority; and
 - (2) does not limit or affect the Province's right with respect to any other breach or non-performance, whether prior or subsequent thereto.
35. The Contractor shall not assign this Agreement, or subcontract any of the work or the services without the prior written approval of the Province, and any assignment or subcontract made without that consent shall be of no effect.
34. The relationship of the Contractor to the Province in performing its services under this Agreement is that of an independent contractor, and nothing in this Agreement is to be construed as creating an agency, partnership or employment relationship between the Contractor and the Province.
35. The Contractor agrees and acknowledges that none of the Contractor, its employees or agents shall by this Agreement be employees of the Province or be entitled to any of the rights or benefits afforded to employees of the Province of Alberta. The crew members shall be employees of the Contractor and not employees or agents of the Province during the term of this Agreement.
36. The Contractor warrants that it is a resident of Canada for income tax purposes and understands that Canadian Law may require certain holdbacks.
37. This Agreement is governed by the laws of the Province of Alberta, and the forum for any legal proceedings relating to this Agreement is the Province of Alberta.
38. This Agreement supersedes and replaces all oral and written communications between the parties relating to the subject matter of this Agreement.
39. Time is of the essence of this Agreement.
40. This Agreement may be executed in counterparts, in which case the counterparts together shall

constitute one Agreement, and communication of execution by fax transmission or e-mailed in PDF shall constitute good delivery.

The parties have made this Agreement by the representatives authorized to do so on the respective dates shown below.

HER MAJESTY THE QUEEN IN RIGHT OF ALBERTA, as represented by the Minister of Sustainable Resource Development.

(Name of the Contractor)

Per:

Per:

Signature

Signature

Print Name

Print Name

Title

Title

Date

Date

Witness Signature

Print Name

SCHEDULE "A"

ROTOR WING SPECIFICATIONS, PERSONNEL AND PAYMENT

1. The following rotor wing aircraft shall be supplied and maintained by the Contractor during the Agreement period for the exclusive use of the Province:

Aircraft:

Substitute aircraft:

SPECIFICATIONS

2. The rotor wing aircraft supplied by the Contractor under this Agreement shall conform, to the following requirements:
 - (1) it shall have seven seats for rappellers as illustrated in Schedule ^{"G"} "F"; rearward facing seat to be a type that conforms to T.C. Regulations. Seat must allow access from co-pilot's seat to rear passenger compartment.
 - (2) It shall be able to carry no less than nine (9) passengers when in non rappel configuration not including seating in the side cargo areas;
 - (3) it shall have an internal freight capacity of at least 2,400 pounds at gross load with full fuel tanks, as measured by the Load Analysis Chart in Schedule ^{"G"} "G"; ^{"H"}
 - (4) it shall have a fuel tank with a capacity of not less than 175 imperial gallons;
 - (5) it shall be equipped with one (1) TSO'd GPS units having a minimum of 4 channels capable of storing up to 100 user inputted way points and having NMEA.0183 standard output with RS232 serial port and ASCII format mounted in a position where coordinates can be entered from the pilot and copilot seat;
 - (6) it shall be equipped with one loud hailer of not less than 100 watts RMS power output with matching speakers activated by switch on cyclic, positioned to enhance audibility at a position directly beneath the aircraft while the aircraft is hovering at 250 AGL;
 - (7) it shall be equipped with high skid gear with short-type bear paws and a skid tube protective cover on the left side, (bear paws shall not extend forward to a point where they will interfere with the webbing on the cargo deployment). Bolts used to attach bear paws to the skid gear shall be streamlined so that they do not interfere with deployment of personnel and gear in a manner that is acceptable to the Province;
 - (8) it shall be equipped with an external cargo suspension hook;
 - (9) it shall come with two cargo nets complete with lanyards;
 - (10) it shall be equipped with two convex mirrors for indirect observation of the sling load by the pilot and co-pilot seats;
 - (11) it shall be equipped with two 4-barrel slings and a 20 foot lanyard to transport not less than eight drums of fuel;

- (12) it shall be equipped for refuelling with one light weight gas powered pump not to exceed 20 kg in weight complete with filter system, anti-spark muffler and maximum 15 feet, 1 1/2 inch summer weight **only** refuelling hose and suction hose. All hose and pumps shall have Camlok fittings. It shall also be equipped with a lightweight electric pump for back up.
- (13) it shall have a wood floor covering throughout the rotor wing starting behind pilot/co-pilot seats and extending into cargo areas (Schedule "F") with access/holes to all hardpoints. Cargo 1 shall come with a durable plastic cover over wooden floor with no holes to hardpoints. Cargo 2 area shall come with a durable plastic cover over wooden floor with holes for cargo hardpoints.
- (14) it shall have its main rotor blades painted in accordance with Schedule "C";
- (15) it shall be equipped with *two* (2) water buckets. One bucket will be described as the initial attack bucket and the other being the sustained action bucket
- (a) The initial attack bucket will:
- (i) Be of a minimum capacity of 270 imperial gallons;
 - (ii) Be able to fit in cargo area 2 without infringing on passenger seating R-4 and R-5 as shown in Schedule F;
- (b) The sustained action bucket will:
- (i) Be of a minimum capacity of 350 imperial gallons
 - (ii) Be multi drop capable
 - (iii) Have the ability to fill completely in shallow water (less than twenty inches)
 - (iv) Be foam capable and be capable of injecting foam at variable ratios from 0.1% - 0.7% by volume - controlled by a digital read-out timer pilot selector setting the number of seconds of pumping desired for foam concentrate/water ratios. The foam systems can be sacs-a-foam, foam injection, or equivalent systems which are acceptable to the Province and do not occupy cabin space, have a minimum 5 gallon capacity, must not weight more than 30 pounds when dry) and compatible with the bucket;
 - (v) All features shall be operable from the long line.
- (c) If either bucket requires batons it shall have an instant deployment system (IDS) to ready the bucket for use
- (d) Both buckets will be supplied and maintained when required and kept operational at the expense of the contractor;
- (e) Both buckets must be acceptable to the Province
- (16) it shall be equipped with a personnel and cargo deployment system as per STC S409-02 or SR02730NY in configuration B with no step. Flight Manual Supplement for this installation and shall be compatible with the Province's Rappel Manual. The personnel and cargo deployment system will be supplied and maintained by the contractor. It is the Contractor's responsibility to receive T.C. approval for use in the rotor wing;
- (17) It shall be equipped with a Province supplied, Transport Canada approved, rappel evacuation beam and bracket as per SH96-46, installed and maintained by the Contractor while in the aircraft;

- (18) Must have sufficient number of tie down points to secure the load from the floor to the ceiling whether it be a single baggage item or multiple stacked baggage items in a manner which is acceptable to the Province;
- (19) it shall be equipped with either nets or lanyards to secure various internal cargo loads in accordance with Transport Canada Regulations and one quickly removable cargo restraining net between cargo 2 and the main cabin;
- (20) it shall be equipped with the following:
- i. Two approved communication audio control panel and headsets with full side tone intercom (Voice operated preferred) to both front seats. This will provide independent receive and transmit capability for the pilot and co-pilot positions on any of the radio systems. The control arrangement will have dual switches, which can be operated independently in both the pilot and co-pilot positions. The co-pilot shall have an operational foot switch for radio/intercom transmission;
 - ii. A minimum of one additional audio control panel with the capabilities readily accessible from either side of the helicopter in the rear passenger compartment and having the same capability as above to selectively and independently transmit and receive on any of the radio systems.
 - iii. The rear system must also have live mike intercom capability (voice operated preferred);
 - iv. It shall have as many high quality headsets as total number of seats. This is also a requirement when the aircraft is in non rappel configuration. Each station must have push-to-talk intercom capability; with dual ear pieces for noise reduction to at least FAA TSO C57 Cat. B, with a "noise-cancelling" microphone, preferably of the Electret type. All rear headsets shall have the ability to receive radio transmissions both outgoing and incoming to the aircraft, except in the outward facing seats.
- (21) it shall be equipped with two (2) VHF/AM voice transceivers:
- i) installed, maintained and kept operational at the expense of the Contractor,
 - ii) meeting all standards specified in respect of VHF/AM receivers under federal statutes and regulations,
 - iii) capable of not less than 720 channels (25 KHz spacing) in the 118 to 136 MHz band, and
 - v) capable of independent operation without either override or interference from audio or R.F.;
- (22) It shall be equipped with two (2) Technosonic TDFM 136B FM programmable transceiver or equivalent capable of programming and retaining 99 or more channels in the frequency range of 138 to 174 MHz with full access to CTCSS sub-audible tones and be switchable by the operator to any of the 32 standard CTCSS tones, and capable of narrow banding feature and of a minimum of one Guard Channel per radio. Both radios must be Project 25 (P25) Compliant.
- (23) Antennas for the 2 FM radios shall be positioned on the aircraft so communications are

not impeded and acceptable to the Province.

- (23) it shall be equipped with one emergency locator transmitter (ELT) of a type currently approved by Transport Canada;
- (24) it shall be equipped with an hour meter connected to the collective control system or the cross tubes of the skid gear, alternately air time may be measured through an onboard computer system that accurately measures air time (skids up to skids down) by the minute or tenths of an hour of the aircraft;
- (25) it shall be equipped with a bubble window on the co-pilot's side;
- (27) the door on the co-pilot's side shall be fully operable from the exterior of the aircraft;
- (28) it shall have seats which can be placed for use in the outward facing seat areas in accordance with "Schedule "F"; "G" ?
- (29) it shall have padding for rear seats certified for open door operations;
- (30) it shall be equipped with hinged protective covers over the handle of the half door on the port side;
- (31) it shall be equipped with two (2) alternating strobes for visibility located forward facing in the vicinity of the rear view mirror underneath the helicopter;
- (31) it shall be equipped with a Satellite based Tracking and Communications system that:
 - i. AFF compliant,
 - ii. Has integrated voice capability,
 - iii. Provides position reporting in two minute intervals,
 - iv. The installed satellite phone can be utilized for incoming and outgoing communication through the headsets. The satellite phone shall be able to be isolated on the communication panel,
 - v. Is powered from the aircraft power supply,
 - vi. Is equipped with an external antenna,
 - vii. Supplied, installed and maintained at the Contractor's expense, including all user charges.
- (32) it shall be equipped with a passenger restraint system that includes shoulder restraint and lap belt. System must allow independent operation of lap belt. These systems must be supplied for the following seating positions: All rear forward facing seats except port side window seat. Both starboard side outward facing seats. It is preferred that the same system be supplied for both rearward facing seat positions and for port side window position. It is preferred that shoulder belts be retractable and be mounted above the shoulder height of passengers in 2012 and is mandatory starting in 2013 for the rear forward facing seats. No system may impede access or egress from rear most passenger compartments;
- (33) the Province can at it's discretion ask the contractor to change the configuration of the rotor wing from the rappel mode to a conventional mode at anytime during the duration of the contract
- (34) it shall be equipped with a long line of at least 100 ft and left front door configured for

long-line operations

- (35) it shall come equipped with latch pin guards (top and bottom) for the sliding doors (total of 4)
- (36) the ceiling hard point station directly behind the co-pilot seat must be free and clear to be utilized by the rappel spotter;
- (37) it shall be satisfactory to the Province in all other respects.

PERSONNEL

- 3. (1) For the term of this Agreement and any renewal made thereof, the Contractor shall supply for the rotor wing aircraft the following crewmembers with the following qualifications:
 - (a) pilots who:
 - 1) are competent to carry out the operations and will perform them safely and efficiently;
 - 2) have a valid and subsisting licence endorsed for rotor wing aircraft of the type, model, class and category being used in the operations;
 - 3) have the following competencies as described in the Helicopter Association of Canada Pilot Competencies for Helicopter Wildfire Operations:
 - 1. General Wildfire Operations Knowledge
 - 2. Mountain Flying External Load – Short Line (horizontal reference) or Long Line (vertical reference),
 - 3. Water Bucketing / Tanking
 - 4. Class D External Loads
 - 5. Hover Exit
 - 6. Confined Area Operations
 - 7. Low Visibility Flight
 - 8. In addition the pilot MUST successfully complete the SRD rappel operations course and evaluation
 - 4) have an accident and violation record that is acceptable to the Province.
 - b) engineers who:
 - 1) are competent to maintain and repair the rotor wing aircraft safely and efficiently;
 - 2) hold an aircraft maintenance engineer (AME) licence in accordance with the ratings and limitations endorsed on the licence. The licence shall be endorsed for rotor wing aircraft in the M1 or M2 category; and
 - 3) in a number necessary to service and maintain the rotor wing aircraft so as to enable it to carry out the operations.

PAYMENT

4. (1) The rotor wing aircraft, operational and complete with pilot and engineer, will be made available by the Contractor to the Province for his exclusive use at the following fees and rates:

Year	Core Period		Pre and Post Season Extension	
	Daily Standby Fee	Hourly Flying Rate		
			Daily Standby	Hourly Rate
2012				
2013				
2014				
2015				
2016				

Double crewed aircraft will be compensated at \$500.00 per day if requested by the Province.

- (2) Positioning the aircraft to the assigned base at the commencement of the operations and depositioning the aircraft following the completion of the operations shall be at no additional cost to the Province.
- (3) If the period during any year of this Agreement for which the Province requires exclusive use of the aircraft for the pre- or post-season extension period of the contract will be in accordance with the rate as established in this contract and stated at Schedule "A" Section 4(1).
- (4) (a) Throughout this Agreement, "unavailability" shall mean:
- The circumstance of and time when the aircraft, pilot or engineer for it is not in condition to perform, fails to perform or is unavailable to perform during the alert/standby period as defined in the Pilots Handbook. Unavailability status will continue to apply each day until the failure and unavailability is corrected.
- (b) For the purposes of this Agreement the Company will be considered to be unavailable whenever in the opinion of the Province, the personnel or equipment are in any of the circumstances, conditions or unavailability referred to in subsection (4)(a) above. Without limiting the Province's right to terminate as otherwise provided in this Agreement, the Province may exercise its right to terminate this Agreement under section 3 of the Agreement for default if there is unavailability in excess of five (5) full consecutive calendar days or an accumulation of ten (10) percent of the total days of the charter period.
- (a) In the event that both the primary and substitute aircraft are unavailable, the Contractor may at its sole discretion, in order to avoid any penalty for being in default, for that failure to supply required aircraft, elect to hire a substitute aircraft that is acceptable to the Province. Should the Contractor so elect to exercise this option, it shall be fully responsible for any and all difference in tariff between the substitute aircraft and the rate as per this Agreement.
- (b) For each day when there is one or more occurrences of unavailability, the Province is entitled to deduct (as liquidated damages) from the daily standby charge otherwise

payable for that day, the "unavailability deduction for a day" which is as defined and determined by the following formula:

$$\text{unavailability deduction} = \text{Daily Standby charge} \times \frac{\text{hours of unavailability that day}}{\text{required availability hours that day}}$$

(c) In the preceding formula:

- (i) "hours of unavailability" means the total hours calculated by adding every 1/2 hour (in this context a 1/2 hour is constituted by an actual 1/2 hour and as well by any portion less than a half-hour) during which unavailability exists or occurs.
 - (ii) "Required Availability Hours for that Day" means the number of hours for which the Province as sole judge for the purpose determines there is a requirement that the aircraft, pilot, or engineer be immediately available or available and airborne for conduct of operations.
- (5) Flying time shall, for the purpose of section 4(1), be calculated in hours and minutes and shall begin when the aircraft departs parking area with engines warmed on a flight ordered by the Province and end when the aircraft has landed to parking, loading or refuelling facilities.
- (a) In the event there is a discrepancy in calculating flying time for the purpose of payment, the documented meter reading on supplied AO-02 form shall be final.
- (6) Fuel for the aircraft shall be supplied at the expense of the Province.
- (7) Invoices and supporting documentation shall be submitted to:

Corporate Services Division
9th Floor, 9920 - 108 Street
Edmonton, AB T5K 2M4

Attention: Aircraft Accounts

SCHEDULE "B"

AIRCREW QUALIFICATIONS

Name	Licence No.	Total Hours	Hours on Type	Hours Flown Previous Year

ENGINEER QUALIFICATIONS

Name	Licence No.	Endorsement	Experience

SCHEDULE "C"

PAINT SCHEMES

The following paint schemes for increased helicopter conspicuousness are acceptable for this contract:

SCHEME A

The upper surfaces of the main rotor blades shall be covered with high visibility paint. Starting at the blade tip, paint the first one-sixth of the blade length with gloss white. Paint the second one-sixth length with yellow or orange. Paint the third one-sixth with gloss white. Paint the next one-third of the blade with lustrous black. Paint the last one-sixth of the blade length with yellow or orange.

W	Y or O	W	B	Y or O	Hub	Y or O	B	W	Y or O	W
1/6	1/6	1/6	1/3	1/6		1/6	1/3	1/6	1/6	1/6

SCHEME B

Using high visibility paint and starting at the blade tip, paint the outer six percent of the blade length gloss white and the next four percent lustrous black. Next, alternately paint white and black sections of fifteen percent each until reaching the hub.

W	B	W	B	W	B	W	B	Hub	B	W	B	W	B	W	B	W
6%	4%	15%	15%	15%	15%	15%	15%		15%	15%	15%	15%	15%	15%	4%	6%

SCHEDULE "D"

RAPATTACK RAPPEL PILOT QUALIFICATIONS

Only personnel certified by the Province as rappel pilots may fly helicopters which are designated rappel capable aircraft.

Qualification involves:

1. rappel familiarization seminar - one day;
2. flying rappel crews during their training phase. The pilot must be able to work with the spotter and demonstrate the ability to continue hover while rappel operations are being conducted.

Rappel familiarization will include:

1. rappel equipment introduction;
2. operational limitations;
3. rappel emergency procedures;
4. retrieval procedures;
5. rappel procedures/cargo deployment;
6. definition of the role of the flight crew;
7. introduction to the rappel crew (tower);
8. simulation of rappel emergencies (tower).
9. additional training as required by program development.
10. SRD policies and overview of provincial fire operations.

Flying will include guidelines for rappel site, height, communications (fire frequencies), etc. Pilots will control the helicopter while personnel rappel into various types of terrain and canopy cover. It is important that the pilot be able to keep the helicopter relatively stationary during all exercises, at an adequate height above the canopy to allow for sufficient slack in the rope, should unexpected problems occur.

When conducting proficiency practices in the field a safe landing site should be available in close proximity, in case of a rotor wing emergency.

Qualification of pilots will follow the SRD Wildfire Rappel Procedures and Training Manual

SCHEDULE "F"

FLIGHT MANUAL SUPPLEMENT



Transport Canada
Sécurité et sûreté

Transports Canada
Sécurité et sûreté

Supplemental Type Approval

This approval is issued to:

Conair Aerospace
P.O. Box 220
Abbotsford, B.C.
V2S 4N9

Number: SH96-46

Issue No.: 1

Approval Date: 30 April 1996

Issue Date: 1 May 1996

Responsible Region:

Pacific

Aircraft/Engine Type or Model:

Bell 205A-1 and 212

Canadian Type Approval or Equivalent:

TC H1SW and TA H-86 (212)

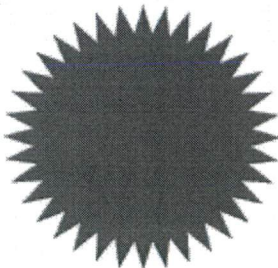
Description of Type Design Change:

Installation of Rappel Evacuation Fitting P/ N CON687-3220

**Installation/Operating Data,
Required Equipment and Limitations:**

Installation is to be carried out in accordance with Conair Master Drawing List CON: 687-3220, revision F, dated June 1987 *. Manufacture of the Rappel Evacuation Beam and Bracket is to be carried out in accordance with Conair CON: 687-4988, revision F dated December 1988 * and CON: 687-4990, revision B, dated October 1986 *.

*(or later approved revision)

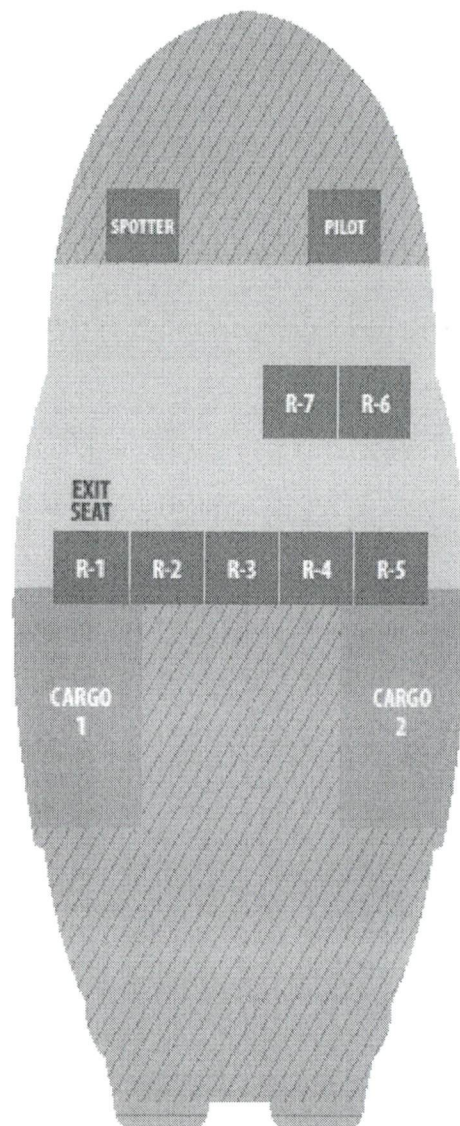


Conditions: This approval is only applicable to the type/model of aeronautical product specified therein. Prior to incorporating this modification, the installer shall establish that the interrelationship between this change and any other modification(s) incorporated will not adversely affect the airworthiness of the modified product.

For Minister of Transport

Canada

SCHEDULE "G"
SEATING ARRANGEMENTS



R - RAPPELLERS

SCHEDULE "H"

LOAD ANALYSIS

Primary Aircraft

Aircraft Registration	
Aircraft Model	
Max. Internal G.W.	
Empty Weight (as supplied without rappel kit)	
Pilot and personal kit (lbs.)	
Survival kit for 10 pax (lbs.)	
Refueling gear (lbs)	
Operational Empty Weight (Note 1)	
Full fuel (lbs.)	
Remaining Available Payload	

Company to annually submit recent weight and balance in fire fighting configuration signed off by an engineer

Note 1 Operational weight includes the weight of radios, satellite tracking, bear paws, tube protector, strobe lights, pilot and personal kit, survival gear, rappel kit

Schedule "I"
Substitute Aircraft

Aircraft Registration	
Aircraft Model	
Max. Internal G.W.	
Empty Weight (as supplied without rappel kit)	
Pilot and personal kit (lbs.)	
Survival kit for 10 pax (lbs.)	
Refueling gear (lbs)	
Operational Empty Weight (Note 1)	
Full fuel (lbs.)	
Remaining Available Payload	

Company to annually submit recent weight and balance in fire fighting configuration signed off by an engineer

Note 1 Operational weight includes the weight of radios, satellite tracking, bear paws, tube protector, strobe lights, pilot and personal kit, survival gear, rappel kit

Schedule “J”

Aircrew Subsistence Rates

Reasonable travel expenses of aircrew, during operations, to board, lodge and transport personnel of the aircraft will be reimbursed at cost upon submission of an invoice with receipts or as specified below, without receipts:

\$70/day for cars;

\$120/day for trucks/vans;

\$49.50/day meal allowance – breakfast - \$12.50
lunch - \$14.00
dinner - \$23.00

\$130/night hotel accommodations

\$190/night hotel accommodations Fort McMurray only

- Rates for meals and accommodations is based on a provincial survey of hotels and restaurants conducted by the Province and will be adjusted annually in April.
- Rates for vehicles will be adjusted annually in April and will be based on the Alberta Road Builders Guide.

The Province will attempt to provide meals and accommodations to the pilot and engineer (if applicable) at the base of operations (camp arrangements). In the event that meals or accommodations are provided by the Province, the Contractor shall not be entitled to invoice the Province for such costs.

April 1, 2011

Rappel Mount / Cargo Arm

Al @ Ascent for 2.

for kit

Best guess.

250-752-2981

AL HANSSON

B.C. RAPPATTACK

2 KITS 22K each
RAP + ARM.

APRIL ~~26~~. 22.

Aero Design Ltd.

2013 - 39 Avenue NE
Calgary, AB
T2E 6R7

Quotation

Date	Quotation #
12/20/2011	4434

Name / Address
Bailey Helicopters Ltd. RR1 Site 7 Compartment 19 Fort St. John, BC V1J 4M6

Description	Total
Alberta / BC Forestry Cargo Deployment Arm Installation, part no. 79201-01 Rappel Mount Provisions, part no. 75801-01 As shown in attached pictures Ref: Discussion with Brent Knight, 15 December 2011	19,500.00
HST 12 Percent	2,340.00
Total	
\$21,840.00	

GST/HST No.

131317178



Transport Canada

Transports Canada

Department of Transport

Supplemental Type Certificate

This approval is issued to:

Aero Design Ltd.
2013 39th Avenue North East
Calgary, Alberta
Canada T2E 6R7

Number: SH09-2

Issue No.: 1

Approval Date: January 22, 2009

Issue Date: January 22, 2009

Responsible Office:

Prairie and Northern

Aircraft/Engine Type or Model:

BELL 205A-1, 205B, 212, 412

Canadian Type Certificate or Equivalent:

BELL 205B H-104
BELL 212, 412 H-86
BELL 205A-1 H1SW

Description of Type Design Change:

Installation of Rappel Mount Provision, Rappel Step, and
Cargo Deployment Arm

**Installation/Operating Data,
Required Equipment and Limitations:**

Configuration A - Rappel Mount Provision Only:

Installation of the Rappel Mount Provision to be completed in accordance with Transport Canada approved, AERO Design Ltd. Document Control List, DCL758-1, Revision 3, dated 14 January 2009, or later approved revision.

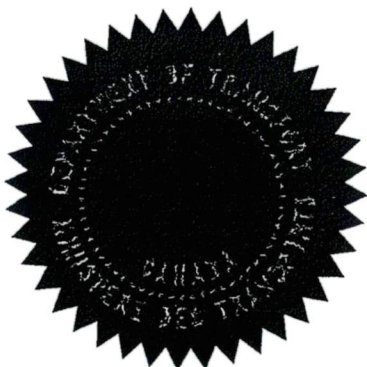
Transport Canada approved, AERO Design Ltd. Flight Manual Supplement FMS758.90, Revision 2, dated 30 December, 2008, or later approved revision is required with this installation.


Configuration B - Rappel Mount Provision with Cargo Deployment Arm:

Installation of the Rappel Mount Provision and Cargo Deployment Arm to be completed in accordance with Transport Canada approved, AERO Design Ltd. Document Control List, DCL792-1, Revision 3, dated 14 January 2009, or later approved revision.

See Continuation Sheet ...

Conditions: This approval is only applicable to the type/model of aeronautical product specified therein. Prior to incorporating this modification, the installer shall establish that the interrelationship between this change and any other modification(s) incorporated **will not** adversely affect the airworthiness of the modified product.




Greg Oucharek
For Minister of Transport

Canada



NOTE: THIS ADDENDUM SHALL REMAIN PART OF THE CERTIFICATE REFERRED TO THEREIN.

Transport Canada approved, AERO Design Ltd. Flight Manual Supplement FMS758.90, Revision 2, dated 30 December, 2008, and Transport Canada approved, AERO Design Ltd. Flight Manual Supplement FMS792.90, Revision 2, dated 30 December, 2008, or later approved revisions are required with this installation

Optional Equipment Installation to Configuration A and B:

Installation of the Rappel step is optional to Configuration A and B. Installation of the Rappel Step is to be completed in accordance with Transport Canada approved, AERO Design Ltd. Document Control List, DCL798-1, Revision 2, dated 14 January 2009, or later approved revision.

Data Pertinent to All Configurations:

Transport Canada accepted, AERO Design Ltd. Instructions for Continued Airworthiness ICA758.90, Revision 2, dated 30 December, 2008, or later accepted revision is required with this installation.

Basis of Certification for installation is CFR 14, Part 29 at amendment 29-2, plus 29.865(a) and 29.865(e) at amendment 29-43.

— End —

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FMS792.90

BELL 212, 412, 205A-1, 205B

ROTORCRAFT FLIGHT MANUAL SUPPLEMENT

for the

INSTALLATION of the CARGO DEPLOYMENT ARM

Supplemental Type Certificate No. SH09-2

Sections 1, 2, 3 and 4 of this document comprise the Transport Canada Approved sections of this Flight Manual Supplement. Compliance with Section 1, Limitations, is mandatory.

Section 5 and any subsequent sections if present are Unapproved and are provided for information only.

The information and data contained in this Flight Manual Supplement supersede or supplement that contained in the basic Approved Flight Manual for the 212, 412, 205A-1 and 205B when fitted with the Cargo Deployment Arm. For limitations, procedures and performance not listed in this Flight Manual Supplement, refer to the Approved Flight Manual and other approved Flight Manual Supplements.



Table of Contents

1	Limitations	3
2	Normal Procedures	5
3	Emergency Procedures	8
4	Performance	8
5	Weight and Balance	9

JAN 22 2009

1 LIMITATIONS

1-3 TYPES OF OPERATIONS:

The Cargo Deployment Arm is an approved provision for non-human, cargo deployment only.

Cargo Deployment operations permitted during VFR conditions only.

1-4 FLIGHT CREW:

Cargo Deployment Operations:

A second crewman to operate the cargo deployment arm is required if cargo deployment operations are to be conducted. The crewman must have full access of the cabin to perform duties as a Cargo Deployment Operations Load Master.

All cargo deployment crew members must wear a protective helmet for moving about in the aircraft.

Carriage of Passengers during non-cargo deployment flights:

All passengers must remain seated with the seatbelt fastened during flight.

JAN 22 2009

1-5 CONFIGURATION:

The aircraft may be equipped with:

A Left Hand Cargo Deployment Arm,

A Right Hand Cargo Deployment Arm, or

Both Left Hand and Right Hand Cargo Deployment Arm.

The sideward facing seats on the left hand side must be removed if the Cargo Deployment Arm is installed on the left hand side of the helicopter.

The sideward facing seats on the right hand side must be removed if the Cargo Deployment Arm is installed on the right hand side of the helicopter.

1-5-A REQUIRED EQUIPMENT FOR CARGO DEPLOYMENT OPERATIONS:

The aircraft must have a functioning communications system between the pilot and the load master.

A hook knife must be;

- i. Carried by the Cargo Deployment Operations Load Master for immediate access, or
- ii. Fixed within the helicopter interior, readily accessible to the Cargo Deployment Operations Load Master, as detail by the operating agency's operating procedures.

1-7 AIRSPEED

Cargo Deployment Operations: Hover with lateral translation at a speed not to exceed 10 knots is permitted for positioning only.

JAN 22 2009

1-20 MARKINGS AND PLACARDS

Placards 79228-01 and 79228-02 to be in clear view of the pilot

**AIRCRAFT MUST BE IN HOVER FOR
CARGO DEPLOYMENT OPERATIONS**

Placard 79228-01

**CARGO DEPLOYMENT OPERATIONS
DURING VFR CONDITIONS ONLY**

Placard 79228-02

The following placard is engraved onto both sides of the Cargo
Deployment Arm.

**MAXIMUM CARGO DEPLOYMENT ARM
CAPACITY
250 LB (113.3 KG)**

JAN 22 2009

2 NORMAL PROCEDURES

2-1 INTRODUCTION:

The Cargo Deployment Arm is approved for non-human cargo deployment operations only. A cargo deployment operation is the continuous controlled decent of cargo from the aircraft to the ground. The cargo is fixed to a suspension line. The suspension line passes through a decent control device, such as a sky-genie or figure-of-eight. The decent of the cargo is controlled by the load master holding the "loose-end" of the suspension line within the cabin of the helicopter.

This section contains instructions for conducting cargo deployment operations.

WARNING

THE CARGO DEPLOYMENT LOAD MASTER SHOULD NOT STOP THE DECENT OF CARGO PRIOR TO REACHING THE GROUND UNLESS THE OPERATIONAL CONDITIONS CHANGE DURING THE DECENT AND REQUIRE THE LOAD MASTER TO DO SO.

WARNING

USING THE CARGO DEPLOYMENT ARM FOR EXTRACTIONS IS NOT PERMITTED.

WARNING

USING THE CARGO DEPLOYMENT ARM FOR HUMAN EXTERNAL CARGO OPERATIONS IS NOT PERMITTED.

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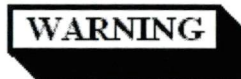
2-3 PREFLIGHT CHECK:

Visually inspect the Cargo Deployment Arm for loose fasteners and wear.

Ensure the roof and floor fittings are properly in position and locked.

2-9 IN FLIGHT OPERATIONS – CARGO DEPLOYMENT OPERATIONS:

Ensure communication between the pilot and the load master is established and maintained.



**STOP CARGO DEPLOYMENT
OPERATIONS IF COMMUNICATION
BETWEEN THE PILOT AND THE LOAD
MASTER HAS FAILED**

Cargo deployment operations may commence only on the pilot's command

Cargo deployment operations must stop on the pilot's command.

The aircraft must be in hover flight during cargo deployment operations

The cargo deployment line must be dropped to the ground when the cargo deployment operation is complete. Do not retract the cargo deployment line into the aircraft.

JAN 22 2009

The load master must observe the cargo deployment operation and communicate to the pilot the status of the cargo deployment operation continuously.

3 EMERGENCY PROCEDURES

Suspension line jettisonability lies within the direct control of the load master under the pilots command. Clear communication between the pilot and the load master must be maintained during cargo deployment operations.

SUSPENSION LINE JETTISON PROCEDURE

On the command of the pilot the load master must jettison the suspension line by:

- i. Releasing the suspension line, or
- ii. Cutting the line with the hook knife provided for the Cargo Deployment Load Master.

WARNING

**THE SUSPENSION LINE MUST BE CUT
AS SHORT AS PRACTICAL.**

**ANY LOOSE LINE REMAINING MUST BE
IMMEDIATELY SECURED TO PREVENT
ANY POSSIBLE ENTANGLEMENT WITH
THE HELICOPTER ROTOR SYSTEM.**

4 PERFORMANCE

No change from basic Rotorcraft Flight Manual.

JAN 22 2009

5 WEIGHT AND BALANCE

English Units		Longitudinal		Lateral	
Item	Weight (Lb)	Arm (in)	Moment (in*Lb)	Arm (in)	Moment (in*Lb)
Left Hand Cargo Deployment Arm 79201-01	12.23	126.0	1541.0	-39.5	-483.1
Right Hand Cargo Deployment Arm 79201-02	12.23	126.0	1541.0	39.5	483.1

Metric Units		Longitudinal		Lateral	
Item	Weight (kg)	Arm (m)	Moment (kg*m)	Arm (m)	Moment (kg*m)
Left Hand Cargo Deployment Arm 79201-01	5.5	3.2	17.6	-1.0	-5.5
Right Hand Cargo Deployment Arm 79201-02	5.5	3.2	17.6	1.0	5.5

Note: 1. Cargo suspended from the Cargo Deployment Arm is located at Fuselage Station 131in and Right Butt Line 57.5in (for Right Hand Cargo Deployment Arm) and/or Left Butt Line -57.5in (for Left Hand Cargo Deployment Arm).

2. The above weight and balance values supersede the weight and balance values in RFMS758.90.

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FMS758.90

BELL 212, 412, 205A-1, 205B

ROTORCRAFT FLIGHT MANUAL SUPPLEMENT

for the

INSTALLATION of RAPPEL MOUNT PROVISION

Supplemental Type Certificate No. SH09-2

Sections 1, 2, 3 and 4 of this document comprise the Transport Canada Approved sections of this Flight Manual Supplement. Compliance with Section 1, Limitations, is mandatory.

Section 5 and any subsequent sections if present are Unapproved and are provided for information only.

The information and data contained in this Flight Manual Supplement supersede or supplement that contained in the basic Approved Flight Manual for the 212, 412, 205A-1 and 205B when fitted with the Rappel Mount Provision. For limitations, procedures and performance not listed in this Flight Manual Supplement, refer to the Approved Flight Manual and other approved Flight Manual Supplements.



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2	Normal Procedures	6
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5	Weight and Balance	10

JAN 22 2009

1 LIMITATIONS

1-3 TYPES OF OPERATIONS:

The Rappel Mount Provision is an approved provision for rappel operations only.

Rappel operations permitted during VFR conditions only.

1-4 FLIGHT CREW:

Rappel Operations:

A second crewman is required as a Rappel Operations Load Master if rappel operations are to be conducted. The crewman must have full access of the cabin to perform duties as a Rappel Operations Load Master.

Rappellers may be present as passengers essential to the operation. The Rappellers must have full access of the passenger area within the cabin to perform duties as a Rappel Crew Member.

All Rappel Crew Members are to be directed by the Rappel Operations Load Master.

The Rappel Operations Load Master and all Rappel Crew Members must wear a protective helmet for moving about in the aircraft.

Carriage of Passengers during non-rappel flights:

All passengers must remain seated with the seatbelt fastened during flight.

JAN 22 2009

1-5 CONFIGURATION:

The aircraft may be equipped with:

A Left Hand Rappel Mount Provision,

A Right Hand Rappel Mount Provision, or

Both Left Hand and Right Hand Rappel Mount Provisions.

1-5-A REQUIRED EQUIPMENT FOR RAPPEL OPERATIONS:

The aircraft must have a functioning communications system between the pilot and the load master.

A hook knife must be;

- i. Carried by the Rappel Operations Load Master for immediate access, or
- ii. Fixed within the helicopter interior, readily accessible to the Rappel Operations Load Master, as detail by the operating agency's operating procedures.

1-7 AIRSPEED

Rappel Operations: Hover with lateral translation at a speed not to exceed 10 knots is permitted for positioning only.

JAN 22 2009

1-20 MARKINGS AND PLACARDS

Placards 75837-01 and 75837-02 to be in clear view of the pilot

**AIRCRAFT MUST BE IN HOVER
FOR RAPPEL OPERATIONS**

Placard 75837-01

**RAPPEL OPERATIONS DURING
VFR CONDITIONS ONLY**

Placard 75837-02

Placard 75837-03 to be attached to Rappel Mount Provision in clear view of the load master.

**MAXIMUM RAPPEL MOUNT CAPACITY
350 LBS
(158 KG)**

Placard 75837-03

JAN 22 2009

2 NORMAL PROCEDURES

2-1 INTRODUCTION:

The Rappel Mount Provision is approved for rappel operations only. A rappel operation is the continuous controlled descent of a single person (the rappeller) from the aircraft to the ground. The rappeller descends on a rope fixed to the Rappel Mount Provision and controls the descent.

This section contains instructions for conducting rappel operations.

WARNING

STOPPING THE DESCENT PRIOR TO REACHING THE GROUND EXPOSES THE RAPPELLER TO RISKS ASSOCIATED WITH RAPPELLING FROM HELICOPTERS. THE RAPPELLER SHOULD NOT STOP THE DESCENT PRIOR TO REACHING THE GROUND UNLESS THE OPERATIONAL CONDITIONS CHANGE DURING THE DESCENT AND REQUIRE THE RAPPELLER TO DO SO.

WARNING

IT IS NOT INTENDED THAT THE RAPPEL MOUNT PROVISION BE USED FOR EXTRACTING PERSONNEL.

JAN 22 2009

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FMS758.90

2-3 PREFLIGHT CHECK:

Visually inspect the Rappel Mount Provision for loose fasteners and wear.

Ensure the roof and floor fittings are properly in position and locked.

JAN 22 2009

2-9

IN FLIGHT OPERATIONS - RAPPEL OPERATIONS:

Ensure communication between the pilot and the load master is established and maintained.

WARNING

**STOP RAPPEL OPERATIONS IF
COMMUNICATION BETWEEN THE PILOT
AND THE LOAD MASTER HAS FAILED**

Rappel operations may commence only on the pilot's command

Rappel operations must stop on the pilot's command.

The aircraft must be in hover flight during rappel operations

The aircraft must maintain an altitude that ensures the rappel line is in contact with the ground.

The rappel rope must be dropped to the ground when the rappel operation is complete. Do not retract the rappel line into the aircraft.

The load master must observe the rappel operation and communicate to the pilot the status of the rappel operation continuously.

JAN 22 2009

3 EMERGENCY PROCEDURES

Suspension line jettisonability lies within the direct control of the load master under the pilots command. Clear communication between the pilot and the load master must be maintained during rappel operations.

SUSPENSION LINE JETTISON PROCEDURE

On the command of the pilot the load master must jettison the suspension line by:

- i. Releasing the suspension line, or
- ii. Cutting the line with the hook knife provided for the Rappel Operations Load Master.

WARNING

**THE SUSPENSION LINE MUST BE CUT
AS SHORT AS PRACTICAL.**

**ANY LOOSE LINE REMAINING MUST BE
IMMEDIATELY SECURED TO PREVENT
ANY POSSIBLE ENTANGLEMENT WITH
THE HELICOPTER ROTOR SYSTEM.**

4 PERFORMANCE

No change from basic Rotorcraft Flight Manual.

JAN 22 2009

5 WEIGHT AND BALANCE

English Units		Longitudinal		Lateral	
Item	Weight (Lb)	Arm (in)	Moment (in*Lb)	Arm (in)	Moment (in*Lb)
Left Hand Rappel Mount Provision 75801-01	7.63	120.4	918.6	-39.5	-301.4
Right Hand Rappel Mount Provision 75801-02	7.63	120.4	918.6	39.5	301.4

Metric Units		Longitudinal		Lateral	
Item	Weight (kg)	Arm (m)	Moment (kg*m)	Arm (m)	Moment (kg*m)
Left Hand Rappel Mount Provision 75801-01	3.5	3.06	10.71	-1.00	-3.5
Right Hand Rappel Mount Provision 75801-02	3.5	3.06	10.71	1.00	3.5

Note: 1. A rappeller suspended from the Rappel Mount Provision is located at Fuselage Station 113in and Right Butt Line 50in (for Right Hand Rappel Mount Provision) and/or Left Butt Line -50in (for Left Hand Rappel Mount Provision).

2. The weight and balance values above are to be used if the Rappel Mount is installed in accordance with Drawing 75801. If the Rappel Mount is installed with a Cargo Arm in accordance with Drawing 79201, then the above weight and balance values are superseded by the weight and balance values found in RFMS792.90.

DOCUMENT CONTROL LIST

DOCUMENT NO.	DOCUMENT CONTENT	REVISION
INSTALLATION DOCUMENTS		
75801	Rappel Mount Provision Installation	1
ICA758.90	Instructions for Continued Airworthiness	2
FMS758.90	Flight Manual Supplement	2
FABRICATION DOCUMENTS		
DCL758-2	Document Control List – Rappel Mount Provision Assembly	2
ENGINEERING DOCUMENTS		


APPROVAL: <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <div style="display: inline-block; text-align: center;"> Transport Canada </div> <div style="display: inline-block; text-align: center;"> Transports Canada </div> </div> <div style="text-align: center; margin-top: 5px;"> AIRCRAFT CERTIFICATION DIVISION </div> <div style="text-align: center; margin-top: 5px;"> APPROVED </div> <div style="margin-top: 5px;"> By: </div> <div style="margin-top: 5px;"> Appr'l No. <u>SH09-2</u> </div> <div style="margin-top: 5px;"> Appr'l Date <u>2009-01-22</u> </div> <div style="margin-top: 5px;"> Issue No. <u>1</u> </div> <div style="margin-top: 5px;"> Issue Date <u>2009-01-22</u> YY - MM - DD </div>	ORIGINAL DATE: 07 May 2008 REVISION DATE: 14 January 2009	<div style="text-align: center; margin-top: 10px;"> AERO DESIGN LTD. 2013 – 39th Ave NE, Calgary, Alberta, T2E 6R7 Ph. (403) 250-8027 Fax. (403) 250-8333 </div>
	SHEET 1 OF 1	Bell 212, 412, 205A-1, 205B Rappel Mount Provision Installation
	<div style="font-size: 2em; font-weight: bold;">DCL758-1</div>	

DOCUMENT CONTROL LIST

DOCUMENT NO.	DOCUMENT CONTENT	REVISION
INSTALLATION DOCUMENTS		
 FABRICATION DOCUMENTS		
75820	Rappel Mount Assembly	1
75824	Assembly, Plug, STN 105	2
75825	Assembly, Plug, Guide	2
75826	Assembly, Plug, 131	2
75830	Tube	1
75831	Retainer	1
75832	Guide	1
75833	Stanchion Adapter	1
75834	Curved Washer	1
75835	Gate Parts	1
75837	Placards	0
75821	Assembly, Guard Ring	0
75822	Assembly, Bearing Ring	0
 ENGINEERING DOCUMENTS		
ER758.01	Engineering Report	0
ER808.01	Engineering Report	0


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ORIGINAL DATE: 07 May 2008 REVISION DATE: 14 January 2009	AERO DESIGN LTD. 2013 - 39 th Ave NE, Calgary, Alberta, T2E 6R7 Ph. (403) 250-8027 Fax. (403) 250-8333							
SHEET 1 OF 1	Bell 212, 412, 205A-1, 205B Rappel Mount Provision Assembly							
DCL758-2	Rev. 2							

DOCUMENT CONTROL LIST

DOCUMENT NO.	DOCUMENT CONTENT	REVISION
INSTALLATION DOCUMENTS		
79201	Cargo Deployment Arm Installation	2
ICA758.90	Instructions for Continued Airworthiness	2
FMS792.90	Flight Manual Supplement	2
FMS758.90	Flight Manual Supplement	2
FABRICATION DOCUMENTS		
DCL792-2	Document Control List Cargo Arm Assembly	2
ENGINEERING DOCUMENTS		
<div> <div> <p>APPROVAL:</p>  </div> <div> <p>ORIGINAL DATE: 07 May 2008</p> <p>REVISION DATE: 14 January 2009</p> </div> <div> <p>AERO DESIGN LTD. 2013 – 39th Ave NE, Calgary, Alberta, T2E 6R7 Ph. (403) 250-8027 Fax. (403) 250-8333</p> </div> </div>		
SHEET 1 OF 1		<p>Bell 212, 412, 205A-1, 205B Cargo Deployment Arm Installation</p>
DCL792-1		<p>Rev.</p> <p>3</p>

DOCUMENT CONTROL LIST


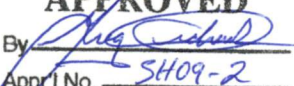
DOCUMENT NO.	DOCUMENT CONTENT	REVISION
INSTALLATION DOCUMENTS		
 FABRICATION DOCUMENTS		
79220	Cargo Deployment Arm Assembly	2
79230	Cargo Arm	1
79231	Bearing Sleeve	1
79232	Cover	1
79233	Bushing	0
79234	Sleeve	0
79235	Lock Leaver	1
79236	Bushing	1
79237	Bushings	1
79221	Cover	0
80120	Bracket	1
79238	Placards	0
 ENGINEERING DOCUMENTS		
ER758.01	Engineering Report	0
ER801.01	Engineering Report	0
ER808.01	Engineering Report	0

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SHEET 1 OF 1		Bell 212, 412, 205A-1, 205B Cargo Deployment Arm Assembly	
<h2 style="margin: 0;">DCL792-2</h2>		Rev. <div style="text-align: center; font-size: 2em; font-weight: bold;">2</div>	

DOCUMENT CONTROL LIST

DOCUMENT NO.	DOCUMENT CONTENT	REVISION
INSTALLATION DOCUMENTS		
79801	Rappel Step Installation	0
ICA758.90	Instructions for Continued Airworthiness	2
FABRICATION DOCUMENTS		
DCL798-2	Document Control List Rappel Step Assembly	1
ENGINEERING DOCUMENTS		
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DCL798-1		Rev. 2

DOCUMENT CONTROL LIST

DOCUMENT NO.	DOCUMENT CONTENT	REVISION
INSTALLATION DOCUMENTS		
FABRICATION DOCUMENTS		
79820	Rappel Step Assembly	0
79830	Step	1
79831	Mounting Plate STN 84	1
79832	Mounting Plate STN 129	1
79833	Block	1
79834	Kick Plate	1
79835	Bushing	1
78230	Step Extrusion	1
ENGINEERING DOCUMENTS		
ER758.01	Engineering Report	0
TP798.02	Test Plan/Report	0
APPROVAL:		
 <div style="display: flex; justify-content: space-between;"> <div>Transport Canada</div> <div>Transports Canada</div> </div> <div style="text-align: center;"> AIRCRAFT CERTIFICATION DIVISION APPROVED </div> <div> By:  Appr'l No. <u>5409-2</u> Appr'l Date <u>2009-01-22</u> Issue No. <u>1</u> Issue Date <u>2009-01-22</u> <small>YY - MM - DD</small> </div>	ORIGINAL DATE: 14 May 2008	AERO DESIGN LTD. 2013 - 39 th Ave NE, Calgary, Alberta, T2E 6R7 Ph. (403) 250-8027 Fax. (403) 250-8333
	REVISION DATE: 14 January 2009	
	SHEET 1 OF 1	Rev.
	DCL798-2	



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Calgary, AB.
T2E 6Z8

Your file Votre référence

Our file Notre référence

C-08-0641

Aero Design Ltd.
2013 39th Avenue N.E.
Calgary, AB
T2E 6R7

January 22, 2009

Attn: Mr. Ted Burgoin

Subject: Issue of Supplemental Type Certificate SH09-2 for Installation of a Rappel Mount Provision, Rappel Step, and Cargo Deployment Arm on Bell 205B, 205A-1, 212 and 412 Rotorcraft

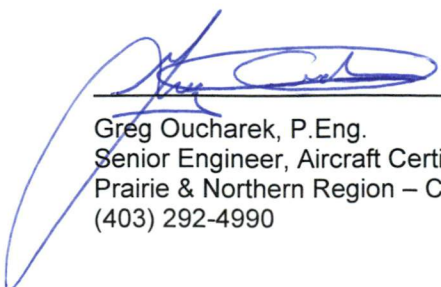
This Supplemental Type Certificate (STC) is issued in response to the application submitted on July 28, 2008 for the subject Design Change.

The transfer of these documents in the name of another person requires a prior approval from the Minister in accordance with Canadian Aviation Regulations (CAR) 513.25.

In accordance with CAR Part V, Subpart 61, a Manufacturing Approval is required for the manufacture of parts or kits which are to be installed by an individual or organization other than the manufacturer. Consult Information Note (ii) following Airworthiness Manual 561.01 (2) for additional guidance.

An STC holder is required to report any service problem experienced with their product. Therefore, should you become aware of any defect, malfunction, or failure resulting from the design change, it is your responsibility to submit a Service Difficulty Report to Transport Canada in accordance with CAR Part V, Subpart 91.

Regards,



Greg Oucharek, P.Eng.
Senior Engineer, Aircraft Certification
Prairie & Northern Region – Calgary
(403) 292-4990

Canada 



Department of Transport

Supplemental Type Certificate

This approval is issued to:

Aero Design Ltd.
2013 39th Avenue North East
Calgary, Alberta
Canada T2E 6R7

Number: SH09-2

Issue No.: 1

Approval Date: January 22, 2009

Issue Date: January 22, 2009

Responsible Office:

Prairie and Northern

Aircraft/Engine Type or Model:

BELL 205A-1, 205B, 212, 412

Canadian Type Certificate or Equivalent:

BELL 205B H-104
BELL 212, 412 H-86
BELL 205A-1 H1SW

Description of Type Design Change:

Installation of Rappel Mount Provision, Rappel Step, and Cargo Deployment Arm

**Installation/Operating Data,
Required Equipment and Limitations:**

Configuration A - Rappel Mount Provision Only:

Installation of the Rappel Mount Provision to be completed in accordance with Transport Canada approved, AERO Design Ltd. Document Control List, DCL758-1, Revision 3, dated 14 January 2009, or later approved revision.

Transport Canada approved, AERO Design Ltd. Flight Manual Supplement FMS758.90, Revision 2, dated 30 December, 2008, or later approved revision is required with this installation.


Configuration B - Rappel Mount Provision with Cargo Deployment Arm:

Installation of the Rappel Mount Provision and Cargo Deployment Arm to be completed in accordance with Transport Canada approved, AERO Design Ltd. Document Control List, DCL792-1, Revision 3, dated 14 January 2009, or later approved revision.

See Continuation Sheet ...

Conditions: This approval is only applicable to the type/model of aeronautical product specified therein. Prior to incorporating this modification, the installer shall establish that the interrelationship between this change and any other modification(s) incorporated **will not** adversely affect the airworthiness of the modified product.




Greg Oucharek
For Minister of Transport

Canada

TRANSFER ENDORSEMENT

A transfer of ownership requires prior approval from the Minister.

The reissue of the certificate in the name of the transferee will be contingent upon a demonstration made by the new owner that he/she can fulfill the responsibilities of the holder as described in Airworthiness Manual Chapter 513.

TRANSFER OF OWNERSHIP

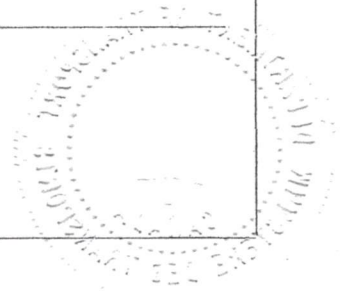
TO (NAME AND ADDRESS OF TRANSFEREE)

FROM (NAME AND ADDRESS OF OWNER)

TRANSFER PARTICULARS (LICENSE
AGREEMENT, SALE OF RIGHTS, ETC.)

DATE OF TRANSFER

SIGNATURE (OF TRANSFERRING OWNER)





NOTE: THIS ADDENDUM SHALL REMAIN PART OF THE CERTIFICATE REFERRED TO THEREIN.

Transport Canada approved, AERO Design Ltd. Flight Manual Supplement FMS758.90, Revision 2, dated 30 December, 2008, and Transport Canada approved, AERO Design Ltd. Flight Manual Supplement FMS792.90, Revision 2, dated 30 December, 2008, or later approved revisions are required with this installation

Optional Equipment Installation to Configuration A and B:

Installation of the Rappel step is optional to Configuration A and B. Installation of the Rappel Step is to be completed in accordance with Transport Canada approved, AERO Design Ltd. Document Control List, DCL798-1, Revision 2, dated 14 January 2009, or later approved revision.

Data Pertinent to All Configurations:

Transport Canada accepted, AERO Design Ltd. Instructions for Continued Airworthiness ICA758.90, Revision 2, dated 30 December, 2008, or later accepted revision is required with this installation.

Basis of Certification for installation is CFR 14, Part 29 at amendment 29-2, plus 29.865(a) and 29.865(e) at amendment 29-43.

— End —



Transport
Canada

Transports
Canada

Aircraft Certification
800-1601 Airport Road N. E.
Calgary, AB.
T2E 6Z8

Your file Votre référence

Our file Notre référence

C-08-0641

Aero Design Ltd.
2013 39th Avenue N.E.
Calgary, AB
T2E 6R7

January 22, 2009

Attn: Mr. Ted Burgoin

Subject: Issue of Supplemental Type Certificate SH09-2 for Installation of a Rappel Mount Provision, Rappel Step, and Cargo Deployment Arm on Bell 205B, 205A-1, 212 and 412 Rotorcraft

This Supplemental Type Certificate (STC) is issued in response to the application submitted on July 28, 2008 for the subject Design Change.

The transfer of these documents in the name of another person requires a prior approval from the Minister in accordance with Canadian Aviation Regulations (CAR) 513.25.

In accordance with CAR Part V, Subpart 61, a Manufacturing Approval is required for the manufacture of parts or kits which are to be installed by an individual or organization other than the manufacturer. Consult Information Note (ii) following Airworthiness Manual 561.01 (2) for additional guidance.

An STC holder is required to report any service problem experienced with their product. Therefore, should you become aware of any defect, malfunction, or failure resulting from the design change, it is your responsibility to submit a Service Difficulty Report to Transport Canada in accordance with CAR Part V, Subpart 91.

Regards,




Greg Oucharek, P.Eng.
Senior Engineer, Aircraft Certification
Prairie & Northern Region – Calgary
(403) 292-4990

Canada

DOCUMENT CONTROL LIST

DOCUMENT NO.	DOCUMENT CONTENT	REVISION
INSTALLATION DOCUMENTS		
75801	Rappel Mount Provision Installation	1
ICA758.90	Instructions for Continued Airworthiness	2
FMS758.90	Flight Manual Supplement	2
FABRICATION DOCUMENTS		
DCL758-2	Document Control List – Rappel Mount Provision Assembly	2
ENGINEERING DOCUMENTS		
<div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> <p>APPROVAL:</p> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <div style="display: flex; justify-content: space-between; font-size: 0.8em;"> Transport Canada Transports Canada </div> <p style="text-align: center; margin: 5px 0;">AIRCRAFT CERTIFICATION DIVISION</p> <p style="text-align: center; font-weight: bold; font-size: 1.2em;">APPROVED</p> <p>By: </p> <p>Appr'l No. <u>SH09-2</u></p> <p>Appr'l Date <u>2009-01-22</u></p> <p>Issue No. <u>1</u></p> <p>Issue Date <u>2009-01-22</u></p> <p style="text-align: center; font-size: 0.7em;">YY - MM - DD</p> </div> </div> <div style="width: 40%;"> <p>ORIGINAL DATE: 07 May 2008</p> <p>REVISION DATE: 14 January 2009</p> </div> <div style="width: 30%; text-align: center;"> <p>AERO DESIGN LTD.</p> <p style="font-size: 0.8em;">2013 – 39th Ave NE, Calgary, Alberta, T2E 6R7</p> <p style="font-size: 0.7em;">Ph. (403) 250-8027 Fax. (403) 250-8333</p> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 30%;"> <p>SHEET 1 OF 1</p> </div> <div style="width: 40%; text-align: center;"> <p>Bell 212, 412, 205A-1, 205B</p> <p>Rappel Mount Provision Installation</p> </div> <div style="width: 30%; text-align: center;"> <p>Rev.</p> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 60%; text-align: center; font-size: 1.5em; font-weight: bold;">DCL758-1</div> <div style="width: 35%; text-align: center; font-size: 2em; font-weight: bold;">3</div> </div>		

DOCUMENT CONTROL LIST

DOCUMENT NO.	DOCUMENT CONTENT	REVISION
INSTALLATION DOCUMENTS		
 FABRICATION DOCUMENTS		
75820	Rappel Mount Assembly	1
75824	Assembly, Plug, STN 105	2
75825	Assembly, Plug, Guide	2
75826	Assembly, Plug, 131	2
75830	Tube	1
75831	Retainer	1
75832	Guide	1
75833	Stanchion Adapter	1
75834	Curved Washer	1
75835	Gate Parts	1
75837	Placards	0
75821	Assembly, Guard Ring	0
75822	Assembly, Bearing Ring	0
 ENGINEERING DOCUMENTS		
ER758.01	Engineering Report	0
ER808.01	Engineering Report	0
 APPROVAL:		
		ORIGINAL DATE: 07 May 2008 REVISION DATE: 14 January 2009
		AERO DESIGN LTD. 2013 - 39 th Ave NE, Calgary, Alberta, T2E 6R7 Ph. (403) 250-8027 Fax. (403) 250-8333
SHEET 1 OF 1		Bell 212, 412, 205A-1, 205B Rappel Mount Provision Assembly
DCL758-2		2

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

APPLICATION FOR TYPE CERTIFICATE, PRODUCTION CERTIFICATE,
OR SUPPLEMENTAL TYPE CERTIFICATE

FORM APPROVED
O.M.B. No. 04-R0078

1. Name and address of applicant

AERO Design Ltd.
2013 - 39 Avenue N.E.
Calgary, Alberta
Canada T2E 6R7

2. Application made for -

- ☐ Type Certificate
☐ Production Certificate
☒ Supplemental Type Certificate

3. Product involved

- ☒ Aircraft
☐ Engine
☐ Propeller

4. TYPE CERTIFICATE (Complete item 4a below)

- a. Model designation(s) (All models listed are to be completely described in the required technical data, including drawings representing the design, material, specifications, construction, and performance of the aircraft, aircraft engine, propeller which is the subject of this application.)

5. PRODUCTION CERTIFICATE (Complete items 5a-c below. Submit with this form, in manual form, one copy of quality control data or changes thereto covering new products, as required by applicable FAR.)

a. Factory address (If different from 1 above)

b. Application is for -

- ☐ New Production Certificate
☐ Additions to Production Certificate (Give P.C. No.)

P.C. No.

c. Applicant is holder of or a licensee under a Type Certificate or a Supplemental Type Certificate
(Attach evidence of licensing agreement and give certificate number) _____

T.C./S.T.C. No.

6. SUPPLEMENTAL TYPE CERTIFICATE (Complete items 6a-d below)

a. Make and model designation of product to be modified
BELL 205A-1, 205B, 212, 412

b. Description of modification

Transport Canada STC # SH09-2
Installation of Rappel Mount Provision, Rappel Step, and Cargo Deployment Arm

c. Will data be available for sale or release to other persons?

☐ YES ☒ NO

d. Will parts be manufactured for sale? (Ref. FAR 21.303)

☒ YES ☐ NO

7. CERTIFICATION - I certify that the above statements are true.

Signature of certifying official

Title
DAR (290M)

PRESIDENT AERO DESIGN

Date
June 2, 2009

AERO Design Ltd.

**ENGINEERING REPORT
ER808.02**

**Rappel Mount Provision
Cargo Deployment Arm
Rappel Step**

Bell 412, 212, 205A-1, 205B

Approved by: E. Burgoin, P. Eng.

Prepared by: Richard Rathwell

Revision 0
Date: 1 June 2009

AERO Design Ltd.
Engineering Consultants

2013 – 39th Avenue N.E., Calgary, Alberta T2E 6R7
Phone: (403) 250-8027
Fax: (403) 250-8333
E-Mail: info@aerodesign.ca

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1.0 INTRODUCTION

The Rappel Mount Provision and Cargo Deployment Arm, approved under TC STC# SH09-2, required changes to the design to ease manufacturing, installation and the like. This report shall act as a bridge to show that the revised and new elements of the installations for the Rappel Mounting Provision and the Cargo Deployment Arm are in compliance with Federal Aviation Regulations. The specific regulations are detailed in the Aero Design Ltd. Document CP758-1 Rev 1, *Compliance Program* and Aero Design Ltd. Document CP758-2 Rev 2, *Compliance Program*.

2.0 REFERENCE

AERO Design Ltd. Drawing 75801 Rappel Mount Provision
AERO Design Ltd. Drawing 79201 Cargo Deployment Arm
AERO Design Ltd. Document CP758-01 *Compliance Program*
AERO Design Ltd. Document CP758-02 *Compliance Program*
AERO Design Ltd. Document ER758.01 *Engineering Report*
AERO Design Ltd. Document ER801.01 *Engineering Report*
AERO Design Ltd. Document ER808.01 *Engineering Report*
Analysis and Design of Flight Vehicle Structures, Bruhn

3.0 BASIS OF CERTIFICATION

Bell 412: FAR Part 29 dated 1 February 1965, Amendment 29-1 and 29-2
Bell 212: FAR Part 29 dated 1 February 1965, Amendment 29-1 and 29-2
Bell 205A-1: CAR 7 dated August 1, 1956, Amendments 7-1 through 7-4
Bell 205B: CAR 7 dated August 1, 1956, Amendments 7-1 through 7-4
This installation: FAR Part 29 dated 1 February 1965, Amendment 29-1 and 29-2 and Amendment 29-43 for 29.865(a) and 29.865(e)

4.0 SUMMARY OF CHANGES

4.1 Rappel Mount Provision Changes

Part/Ass'y Number	Description	Change?		Description of Change(s)	New Revision	Engineering Consideration (Structural)
		Yes	No			
75801-01	Rappel Mount Provision Inst'l LH	X		Various	2	1. Slot for adjustable installation considered (see Para 5.1) and is acceptable. 2. Hardware changed for guard rings to ease installation. This part bears no load. This part is acceptable. 3. The assembly of the guard rings changed to ease assembly. This assembly bears no load. This assembly is acceptable.
75801-02	Rappel Mount Provision Inst'l RH	X		Various (opposite 75801-01)	2	N/A (see 75801-01)
75801-11	Rappel Mount Inst'l Ass'y LH		X	Revision level changed as a consequence of the drawing having been revised to accommodate unrelated changes to this ass'y on the same drawing.	2	N/A.
75801-12	Rappel Mount Inst'l Ass'y RH		X	Revision level changed as a consequence of the drawing having been revised to accommodate unrelated changes to this ass'y on the same drawing.	2	N/A.
75820-01	Rappel Mount Ass'y LH	X		Parts modified to ease installation.	2	Slots added to the parts of the assembly had been added to ease adjustability at installation. The result effects have been analyzed at the installation level and found acceptable. (see Para 5.1).
75820-02	Rappel Mount Ass'y RH	X		(opposite 75820-01)	2	N/A (see 75820-01)
75822-02	Assembly, Bearing Ring	X		Part geometry changed to ease manufacturing.	1	Material was added to the part as a consequence of the change. Therefore the structural performance capability of this part has not been reduced. This part is acceptable.
75821-01	Guard Ring	X		This part was modified to match with the newly introduced part 75821-02 at installation 75801 to ease installation of the guard rings.	1	This part bears no load. This part is acceptable.
75821-02	Assembly, Guard Ring	NEW		This part was introduced to match with 75821-01 at installation 75801 to ease the installation of the guard rings.	1	This part bears no load. This part is acceptable.
75824-01	Plug, STN 105	X		Slot added to ease installation	3	Part is acceptable. (see Para 5.1)

Part/Ass'y Number	Description	Change?		Description of Change(s)	New Revision	Engineering Consideration (Structural)
		Yes	No			
75826-01	Assembly, Plug, STN 131	X		Removed redundant feature	1	This part was accepted as part of C-LSTC08-157/D. The function of this part remains the same. This part is acceptable.
75830-01	Tube	X		Slot added to ease installation	2	Part is acceptable. (see Para 5.1)
60624	Barrel Nut		New into this inst'l	This barrel nut is added to work in concert with the newly added slot in the forward-most parts to ease installation	0	Part is acceptable. See Para 5.1.
75831-01	Retainer	X		Fillet on part changed to accommodate smaller rope thimbles.	2	The material loss has been considered (see Para 5.2). The part is acceptable.
75835-01	Gate Plunger	X		Part geometry changed	2	This part bears no load. This part is acceptable.
75835-02	Gate Knob	X		Part geometry changed	2	This part bears no load. This part is acceptable.

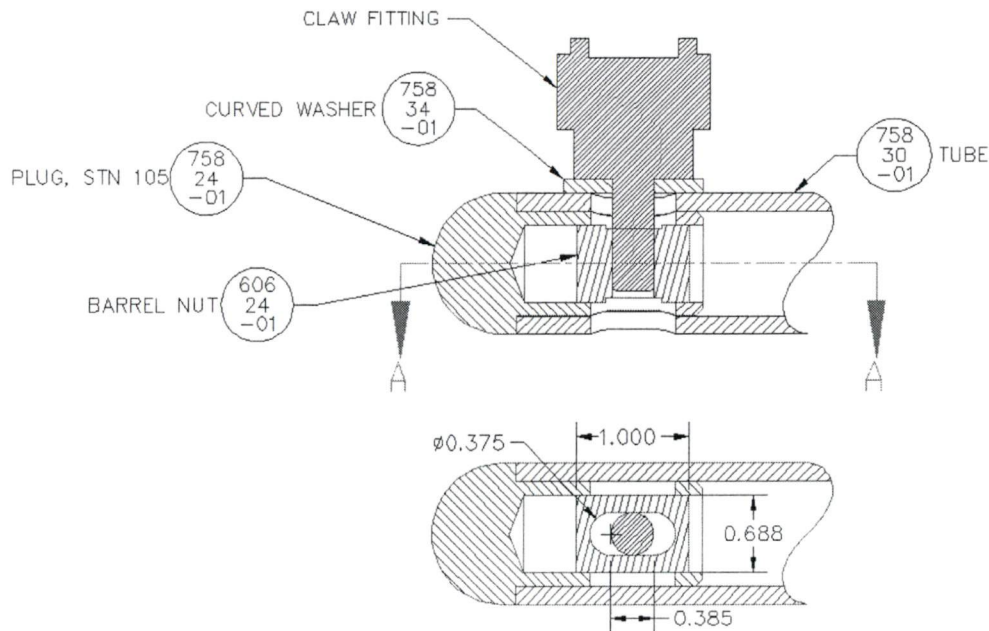
4.2 Cargo Deployment Arm Changes

Part/Ass'y Number	Description	Change?		Description of Change(s)	New Revision	Engineering Consideration (Structural)
		Yes	No			
79201-01	Cargo Deployment Arm Inst'l LH	X		Various	3	1. Slot for adjustable installation considered (see Para 5.1) and is acceptable. 2. Hardware changed for guard rings to ease installation. This part bears no load. This part is acceptable. 3. The assembly of the guard rings changed to ease assembly. This assembly bears no load. This assembly is acceptable.
79201-02	Cargo Deployment Arm Inst'l RH	X		Various (opposite 79201-01)	3	N/A (see 79201-01)
79201-11	Cargo Arm Inst'l Ass'y LH	X		Revision level changed as a consequence of the drawing having been revised to accommodate unrelated changes to this ass'y on the same drawing.	3	N/A
79201-12	Cargo Arm Inst'l Ass'y RH	X		N/A. Revision level changed as a consequence of the drawing having been revised to accommodate unrelated changes to this ass'y on the same drawing.	3	N/A
79220-01-01	Cargo Deployment Arm Ass'y Std Eye	X		Lock lever bushing and lock lever changed to ease manufacturing.	3	N/A. The changes do not affect the structure performance or functionality of the assembly. The changes are acceptable.
79220-01-02	Cargo Deployment Arm Ass'y Std Eye - Shackle	X		Same as 79220-01-01	3	Same as 79220-01-01
79220-01-03	Cargo Deployment Arm Ass'y Dropped Eye	X		Same as 79220-01-01	3	Same as 79220-01-01
79220-01-04	Cargo Deployment Arm Ass'y Dropped Eye - Shackle	X		Same as 79220-01-01	3	Same as 79220-01-01

Part/Ass'y Number	Description	Change?		Description of Change(s)	New Revision	Engineering Consideration (Structural)
		Yes	No			
79231-01	Bearing Sleeve	X		Part modified to fit LH and RH Cargo Deployment Arm Inst'l	2	The modification is to allow the part to fit the LH and RH Cargo Deployment Arm Inst'l. The modification does not change the relevant structure of the part. This part is acceptable.
79232-01	Cover	X		Change to geometry	2	This part bears no load. This part is acceptable.
79233-01	Bushing		X	Change to geometry to improve fit.	1	The modification does not change the relevant structure of the part. This part is acceptable.
79235-01	Lock Leaver	X		Geometry change to provide more clearance with the aircraft door frame.	2	Change does not affect structure. This part is acceptable.
79236-01	Bushing, Carabiner	X		Removal of the groove which was originally intended for locking the bushing to the cargo arm with a pin.	2	The locking of the bushing was determined to be unnecessarily redundant. Change does not affect structure. This part is acceptable.
79236-02	Bushing, Shackle	X		Removal of the groove which was originally intended for locking the bushing to the cargo arm with a pin.	2	The locking of the bushing was determined to be unnecessarily redundant. Change does not affect structure. This part is acceptable.
79237-01	Bushing	X		79237-01 and 79237-02 merged to form one part to improve design.	2	Change does not affect structure. This part is acceptable.

5.0 STRUCTURAL ANALYSIS OF ELEMENT CHANGES

5.1 Rappel Mount Adjustability Changes



BARREL NUT THREAD STRENGTH PERFORMANCE

VERTICAL REACTION @ ROOF FITTING 3 (PER ER758.01) = 1468.6 LBF
 THREAD DIAMETER (NOMINAL) = 0.375 IN
 PITCH = 24 THREAD PER INCH
 LENGTH OF THREAD ENGAGEMENT = 0.5 IN
 PITCH DIAMETER (PER MACHINIST HANDBOOK) = 0.3479 IN

$$AERA_SHEAR = \pi \times \text{PITCH DIAMETER} \times \frac{\text{LENGTH ENGAGEMENT}}{2}$$

$$AERA_SHEAR = 0.273 \text{ IN}^2$$

$$\text{SHEAR STRESS} = \frac{\text{VERTICAL REACTION @ ROOF FITTING 3}}{AERA_SHEAR}$$

$$\text{SHEAR STRESS} = 5380 \text{ PSI}$$

STAINLESS STEEL SHEAR STRENGTH PERFORMANCE IS
 GREATER THAN 5380 PSI. THREAD IS ACCEPTABLE.

ALUMINUM PLUG BEARING STRENGTH PERFORMANCE

VERTICAL REACTION @ ROOF FITTING 3 (PER ER758.01) = 1468.6 LBF
 THREAD DIAMETER (NOMINAL) = 0.375 IN
 PITCH = 24 THREAD PER INCH
 LENGTH OF THREAD ENGAGEMENT = 0.5 IN
 PITCH DIAMETER (PER MACHINIST HANDBOOK) = 0.3479 IN

$$AERA_BEARING = 1.0 \text{ IN} \times 0.688 \text{ IN} - \left(\pi \times \frac{0.375 \text{ IN}^2}{2} + 0.375 \text{ IN} \times 0.385 \text{ IN} \right)$$

$$AERA_BEARING = 0.433 \text{ IN}^2$$

$$\text{BEARING STRESS} = \frac{\text{VERTICAL REACTION @ ROOF FITTING 3}}{AERA_BEARING}$$

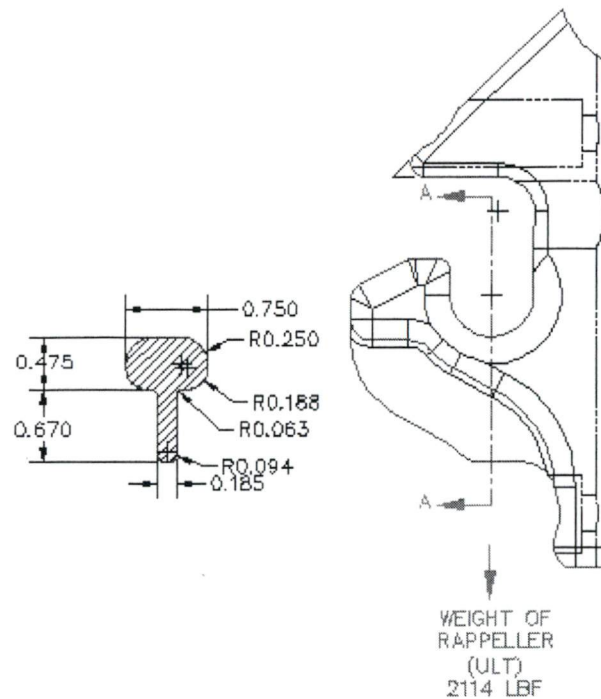
$$\text{BEARING STRESS} = 3392 \text{ PSI}$$

6061-T6 ALUMINUM $F_{BRU} = 42 \text{ KSI}$

$$\text{MARGIN OF SAFETY} = \frac{6061\text{-T6 ALUMINUM } F_{BRU}}{\text{BEARING STRESS}} - 1$$

$$\text{MARGIN OF SAFETY} = 11.3$$

5.2 Filleting of the Retainer



REDUCTION OF SHEAR AREA OF RETAINER

FORCE (WEIGHT OF RAPPELLER @ ULTIMATE PER ER758.01) = 2114 LBF
 AREA_SHEAR (SECTION A-A) = 0.428 IN²

$$\text{SHEAR STRESS} = \frac{\text{FORCE}}{\text{AREA_SHEAR}}$$

SHEAR STRESS = 4940 PSI

6061-T6 ALUMINUM F_{su} = 42 KSI

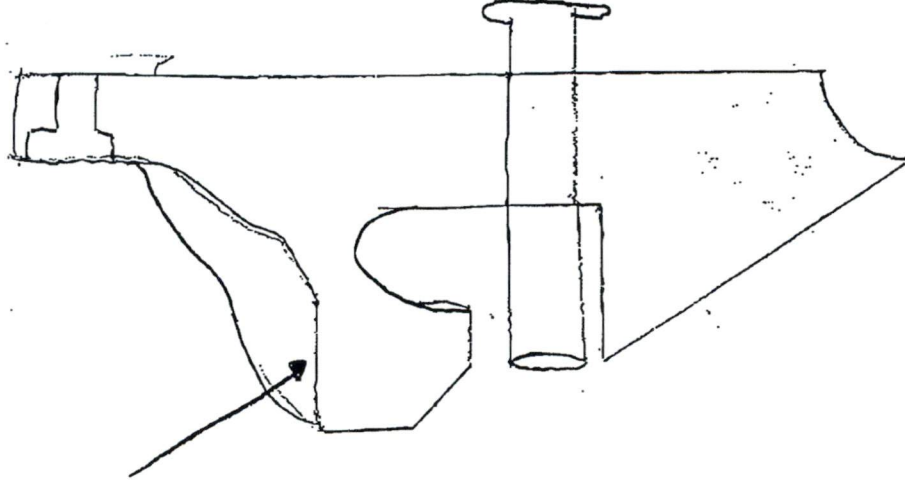
$$\text{MARGIN OF SAFETY} = \frac{6061\text{-T6 ALUMINUM } F_{su}}{\text{SHEAR STRESS}} - 1$$

MARGIN OF SAFETY = 7.5

THIS IS THE EDGE IN QUESTION.

IN BOARD
↓

FWD-7



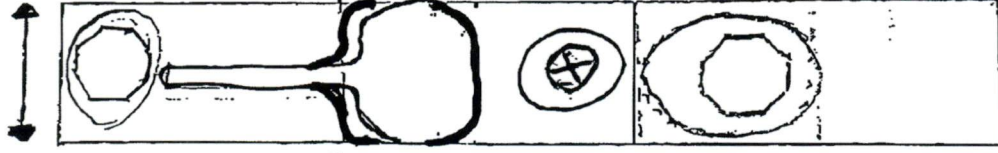
VIEW LOOKING UP

THIS BEVELD NEEDS TO BE REMOVED. .650" THICK
IT IS CURRENTLY .750" THICK AND .750" WIDE
PROPOSE MACHINING .100" OF MATERIAL OFF
INSIDE EDGE AS NEW MACHINED LAMB

UP
↓

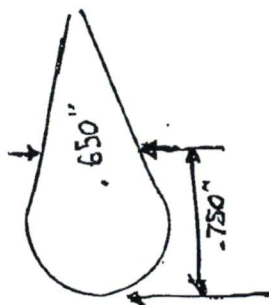
.750"

FWD-7

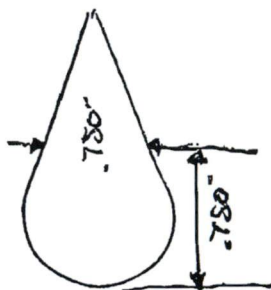


VIEW LOOKING OUT BOARD

THUMBLE SAW '08
DOES NOT FIT



THUMBLE NOV '08
FITS



FORM AE-100

DEPARTMENT OF TRANSPORT STATEMENT OF COMPLIANCE OF AIRCRAFT OR AIRCRAFT COMPONENTS WITH THE AIRWORTHINESS REQUIREMENTS			AE-100 No.: AE808-2 Initial Issue Date: 14 January 2009 Revision: 1 Revision Date: 01 June 2009 Approval No.: Delegation No.: 290M Delegate Name: E. Burgoin Classification of Designee: Employer: AERO Design Ltd.
Aircraft Mfr: Bell Helicopters Aircraft Model: 212, 412, 205A-1, 205B Registration: ALL ELIGIBLE	Model Type Airplane <input type="checkbox"/> Helicopter <input checked="" type="checkbox"/> Appliance <input type="checkbox"/> Component <input type="checkbox"/>		

LIST OF APPROVED REPORTS AND DATA				
Document Number	Revision	Document Title	Compliance Status	
DCL758-1 75801	Revision 4 Revision 2	Document Control List Rappel Mount Provision Installation	As per Compliance CP758-2 Rev 2	
DCL758-2 75820	Revision 3 Revision 2	Document Control List Rappel Mount Assembly		
75824	Revision 3	Plug, STN 105		
75825	Revision 2	Assembly, Plug, Guide		
75826	Revision 1	Assembly, Plug, 131		
75830	Revision 2	Tube		
75831	Revision 1	Guide		
75832	Revision 2	Retainer		
75833	Revision 1	Stanchion Adapter		
75834	Revision 1	Curved Washer		
75835	Revision 2	Gate Parts		
75837	Revision 0	Placards		
75821	Revision 1	Assembly, Guard Ring		
75822	Revision 1	Assembly, Bearing Ring		
60624	Revision 0	Barrel Nut		
ER808.02	Revision 0	Engineering Report		
ER758.01	Revision 0	Engineering Report		
ER808.01	Revision 0	Engineering Report		
DATA APPROVED BY TRANSPORT CANADA				

CERTIFICATION


UNDER THE AUTHORITY VESTED IN ME BY THE DEPARTMENT OF TRANSPORT, I HEREBY CERTIFY THAT THE DATA LISTED ABOVE AND ON THE ATTACHED SHEETS NUMBERED Nil HAVE BEEN EXAMINED IN ACCORDANCE WITH ESTABLISHED PROCEDURES AND FOUND TO COMPLY, TO THE BEST OF MY KNOWLEDGE AND BELIEF WITH THE PERTINENT COMPLIANCE REQUIRMENTS.

I THEREFORE ☐ RECOMMEND FOR APPROVAL OF THESE DATA



☒ APPROVE THESE DATA

E. Burgoin, DAR 290M

FORM AE-100

DEPARTMENT OF TRANSPORT STATEMENT OF COMPLIANCE OF AIRCRAFT OR AIRCRAFT COMPONENTS WITH THE AIRWORTHINESS REQUIREMENTS		AE-100 No.: AE808-3 Initial Issue Date: 14 January 2009 Revision: 1 Revision Date: 1 June 2009 Approval No.: Delegation No.: 290M Delegate Name: E. Burgoin Classification of Designee: Employer: AERO Design Ltd.	
Aircraft Mfr: Bell Helicopters Aircraft Model: 212, 412, 205A-1, 205B Registration: ALL ELIGIBLE		Model Type Airplane <input type="checkbox"/> Helicopter <input checked="" type="checkbox"/> Appliance <input type="checkbox"/> Component <input type="checkbox"/>	
LIST OF APPROVED REPORTS AND DATA			
Document Number		Document Title	Compliance Status
DCL792-1 79201	Revision 4 Revision 3	Document Control List Cargo Deployment Arm Installation	As per Compliance CP758-1 Rev 1
DCL792-2 79220	Revision 3	Document Control List	
79230	Revision 3	Cargo Deployment Arm Assembly	
79231	Revision 1	Cargo Arm	
79232	Revision 2	Bearing Sleeve	
79233	Revision 2	Cover	
79234	Revision 1	Bushing	
79235	Revision 0	Sleeve	
79236	Revision 2	Lock Leaver	
79237	Revision 2	Bushing	
79238	Revision 2	Bushings	
79221	Revision 0	Placards	
80120	Revision 0	Cover	
	Revision 1	Bracket	
ER808.02	Revision 0	Engineering Report	
ER801.01	Revision 0	Engineering Report	
ER758.01	Revision 0	Engineering Report	
ER808.01	Revision 0	Engineering Report	
DATA APPROVED BY TRANSPORT CANADA			
CERTIFICATION UNDER THE AUTHORITY VESTED IN ME BY THE DEPARTMENT OF TRANSPORT, I HEREBY CERTIFY THAT THE DATA LISTED ABOVE AND ON THE ATTACHED SHEETS NUMBERED Nil HAVE BEEN EXAMINED IN ACCORDANCE WITH ESTABLISHED PROCEDURES AND FOUND TO COMPLY, TO THE BEST OF MY KNOWLEDGE AND BELIEF WITH THE PERTINENT COMPLIANCE REQUIREMENTS.			
I THEREFORE <input type="checkbox"/> RECOMMEND FOR APPROVAL OF THESE DATA <input checked="" type="checkbox"/> APPROVE THESE DATA			
 E. Burgoin, DAR 290M			


DOCUMENT CONTROL LIST

DOCUMENT NO.	DOCUMENT CONTENT	REVISION
INSTALLATION DOCUMENTS		
75801	Rappel Mount Provision Installation	2
ICA758.90	Instructions for Continued Airworthiness	2
FMS758.90	Flight Manual Supplement	2
FABRICATION DOCUMENTS		
DCL758-2	Document Control List – Rappel Mount Provision Assembly	3
ENGINEERING DOCUMENTS		
<div> <div> APPROVAL:  Transport Canada E. BURGAIN DAR 290M APPROVED By:  Appr'l No. <u>SH09-12</u> Appr'l Date <u>22 Jan 2009</u> Issue No. <u>1</u> Issue Date <u>22 Jan 2009</u> </div> <div> ORIGINAL DATE: 07 May 2008 REVISION DATE: 1 June 2009 </div> <div> AERO DESIGN LTD. 2013 – 39th Ave NE, Calgary, Alberta, T2E 6R7 Ph. (403) 250-8027 Fax. (403) 250-8333 </div> </div>		
SHEET 1 OF 1		Bell 212, 412, 205A-1, 205B Rappel Mount Provision Installation
DCL758-1		Rev. 4

Re-issued 8 June 2009.

DOCUMENT CONTROL LIST

DOCUMENT NO.	DOCUMENT CONTENT	REVISION
INSTALLATION DOCUMENTS		
FABRICATION DOCUMENTS		
75820	Rappel Mount Assembly	2
75824	Plug, STN 105	3
75825	Assembly, Plug, Guide	2
75826	Assembly, Plug, 131	1
75830	Tube	2
75831	Guide	1
75832	Retainer	2
75833	Stanchion Adapter	1
75834	Curved Washer	1
75835	Gate Parts	2
75837	Placards	0
75821	Assembly, Guard Ring	1
75822	Assembly, Bearing Ring	1
60624	Barrel Nut	0
ENGINEERING DOCUMENTS		
ER758.01	Engineering Report	0
ER808.01	Engineering Report	0
ER808.02	Engineering Report	0

APPROVAL:  Transport Canada E. BURGOIN DAR 250M APPROVED By <i>[Signature]</i> Appr No. <u>SHO 4-2</u> Appr'l Date <u>22 Jan 2009</u> Issue No. <u>1</u> Issue Date <u>22 Jan 2009</u> Re-Issued 8 June 2009	ORIGINAL DATE: 07 May 2008 REVISION DATE: 1 June 2009	AERO DESIGN LTD. 2013 - 39 th Ave NE, Calgary, Alberta, T2E 6R7 Ph. (403) 250-8027 Fax. (403) 250-8333	
	SHEET 1 OF 1	Bell 212, 412, 205A-1, 205B Rappel Mount Provision Assembly	
	<table style="width: 100%;"> <tr> <td style="width: 70%; text-align: center; font-size: 2em; font-weight: bold;">DCL758-2</td> <td style="width: 30%; text-align: center; font-size: 3em; font-weight: bold;">3</td> </tr> </table>		DCL758-2
DCL758-2	3		

DOCUMENT CONTROL LIST

DOCUMENT NO.	DOCUMENT CONTENT	REVISION
INSTALLATION DOCUMENTS		
79201	Cargo Deployment Arm Installation	3
ICA758.90	Instructions for Continued Airworthiness	2
FMS792.90	Flight Manual Supplement	2
FMS758.90	Flight Manual Supplement	2
FABRICATION DOCUMENTS		
DCL792-2	Document Control List Cargo Arm Assembly	3
DCL758-2	Document Control List Rappel Mount Assembly	3
ENGINEERING DOCUMENTS		

APPROVAL:

 Transport Canada
 E. BURGAIN
 DAR 290M
 APPROVED
 By *[Signature]*
 Appr'l No. SH09-2
 Appr'l Date 22 JAN 2009
 Issue No. 1
 Issue Date 22 JAN 2009
 RE-ISSUED 8 JUNE 2009.

ORIGINAL DATE:

07 May 2008

REVISION DATE:

1 June 2009

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SHEET 1 OF 1

**Bell 212, 412, 205A-1, 205B
 Cargo Deployment Arm
 Installation**

Rev.

DCL792-1

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DOCUMENT CONTROL LIST

DOCUMENT NO.	DOCUMENT CONTENT	REVISION
INSTALLATION DOCUMENTS		
FABRICATION DOCUMENTS		
79220	Cargo Deployment Arm Assembly	3
79230	Cargo Arm	1
79231	Bearing Sleeve	2
79232	Cover	2
79233	Bushing	1
79234	Sleeve	0
79235	Lock Leaver	2
79236	Bushing	2
79237	Bushings	2
79221	Cover	0
80120	Bracket	1
79238	Placards	0
ENGINEERING DOCUMENTS		
ER758.01	Engineering Report	0
ER801.01	Engineering Report	0
ER808.01	Engineering Report	0
ER808.02	Engineering Report	0

APPROVAL

Transport Canada
E. BURGAIN
DAR 290M

APPROVED

By *[Signature]*

Appr'l No. *SH09-2*

Appr'l Date *22 JAN 2009*

Issue No. *1*

Issue Date *22 JAN 2009*

RE-ISSUED 8 JUNE 2009

ORIGINAL DATE:

07 May 2008

REVISION DATE:

1 June 2009

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SHEET 1 OF 1

**Bell 212, 412, 205A-1, 205B
Cargo Deployment Arm
Assembly**

Rev.

DCL792-2

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FMS758.90

BELL 212, 412, 205A-1, 205B

ROTORCRAFT FLIGHT MANUAL SUPPLEMENT

for the

INSTALLATION of RAPPEL MOUNT PROVISION

Supplemental Type Certificate No. SH09-2

Sections 1, 2, 3 and 4 of this document comprise the Transport Canada Approved sections of this Flight Manual Supplement. Compliance with Section 1, Limitations, is mandatory.

Section 5 and any subsequent sections if present are Unapproved and are provided for information only.

The information and data contained in this Flight Manual Supplement supersede or supplement that contained in the basic Approved Flight Manual for the 212, 412, 205A-1 and 205B when fitted with the Rappel Mount Provision. For limitations, procedures and performance not listed in this Flight Manual Supplement, refer to the Approved Flight Manual and other approved Flight Manual Supplements.



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FMS758.90

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2	Normal Procedures	6
3	Emergency Procedures	9
4	Performance	9
5	Weight and Balance	10

JAN 22 2009

1 LIMITATIONS

1-3 TYPES OF OPERATIONS:

The Rappel Mount Provision is an approved provision for rappel operations only.

Rappel operations permitted during VFR conditions only.

1-4 FLIGHT CREW:

Rappel Operations:

A second crewman is required as a Rappel Operations Load Master if rappel operations are to be conducted. The crewman must have full access of the cabin to perform duties as a Rappel Operations Load Master.

Rappellers may be present as passengers essential to the operation. The Rappellers must have full access of the passenger area within the cabin to perform duties as a Rappel Crew Member.

All Rappel Crew Members are to be directed by the Rappel Operations Load Master.

The Rappel Operations Load Master and all Rappel Crew Members must wear a protective helmet for moving about in the aircraft.

Carriage of Passengers during non-rappel flights:

All passengers must remain seated with the seatbelt fastened during flight.

JAN 22 2009

1-5 CONFIGURATION:

The aircraft may be equipped with:

A Left Hand Rappel Mount Provision,

A Right Hand Rappel Mount Provision, or

Both Left Hand and Right Hand Rappel Mount Provisions.

1-5-A REQUIRED EQUIPMENT FOR RAPPEL OPERATIONS:

The aircraft must have a functioning communications system between the pilot and the load master.

A hook knife must be;

- i. Carried by the Rappel Operations Load Master for immediate access, or
- ii. Fixed within the helicopter interior, readily accessible to the Rappel Operations Load Master, as detail by the operating agency's operating procedures.

1-7 AIRSPEED

Rappel Operations: Hover with lateral translation at a speed not to exceed 10 knots is permitted for positioning only.

JAN 22 2009

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FMS758.90

1-20 MARKINGS AND PLACARDS

Placards 75837-01 and 75837-02 to be in clear view of the pilot

**AIRCRAFT MUST BE IN HOVER
FOR RAPPEL OPERATIONS**

Placard 75837-01

**RAPPEL OPERATIONS DURING
VFR CONDITIONS ONLY**

Placard 75837-02

Placard 75837-03 to be attached to Rappel Mount Provision in clear view of the load master.

**MAXIMUM RAPPEL MOUNT CAPACITY
350 LBS
(158 KG)**

Placard 75837-03

JAN 22 2009

2 NORMAL PROCEDURES

2-1 INTRODUCTION:

The Rappel Mount Provision is approved for rappel operations only. A rappel operation is the continuous controlled descent of a single person (the rappeller) from the aircraft to the ground. The rappeller descends on a rope fixed to the Rappel Mount Provision and controls the descent.

This section contains instructions for conducting rappel operations.

WARNING

STOPPING THE DESCENT PRIOR TO REACHING THE GROUND EXPOSES THE RAPPELLER TO RISKS ASSOCIATED WITH RAPPELLING FROM HELICOPTERS. THE RAPPELLER SHOULD NOT STOP THE DESCENT PRIOR TO REACHING THE GROUND UNLESS THE OPERATIONAL CONDITIONS CHANGE DURING THE DESCENT AND REQUIRE THE RAPPELLER TO DO SO.

WARNING

IT IS NOT INTENDED THAT THE RAPPEL MOUNT PROVISION BE USED FOR EXTRACTING PERSONNEL.

JAN 27 2009

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FMS758.90

2-3

PREFLIGHT CHECK:

Visually inspect the Rappel Mount Provision for loose fasteners and wear.

Ensure the roof and floor fittings are properly in position and locked.

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TRANSPORT CANADA APPROVED |

JAN 22 2009

2-9

IN FLIGHT OPERATIONS - RAPPEL OPERATIONS:

Ensure communication between the pilot and the load master is established and maintained.

WARNING

**STOP RAPPEL OPERATIONS IF
COMMUNICATION BETWEEN THE PILOT
AND THE LOAD MASTER HAS FAILED**

Rappel operations may commence only on the pilot's command

Rappel operations must stop on the pilot's command.

The aircraft must be in hover flight during rappel operations

The aircraft must maintain an altitude that ensures the rappel line is in contact with the ground.

The rappel rope must be dropped to the ground when the rappel operation is complete. Do not retract the rappel line into the aircraft.

The load master must observe the rappel operation and communicate to the pilot the status of the rappel operation continuously.

JAN 22 2009

3 EMERGENCY PROCEDURES

Suspension line jettisonability lies within the direct control of the load master under the pilots command. Clear communication between the pilot and the load master must be maintained during rappel operations.

SUSPENSION LINE JETTISON PROCEDURE

On the command of the pilot the load master must jettison the suspension line by:

- i. Releasing the suspension line, or
- ii. Cutting the line with the hook knife provided for the Rappel Operations Load Master.

WARNING

**THE SUSPENSION LINE MUST BE CUT
AS SHORT AS PRACTICAL.**

**ANY LOOSE LINE REMAINING MUST BE
IMMEDIATELY SECURED TO PREVENT
ANY POSSIBLE ENTANGLEMENT WITH
THE HELICOPTER ROTOR SYSTEM.**

4 PERFORMANCE

No change from basic Rotorcraft Flight Manual.

JAN 22 2009

5 WEIGHT AND BALANCE

English Units		Longitudinal		Lateral	
Item	Weight (Lb)	Arm (in)	Moment (in*Lb)	Arm (in)	Moment (in*Lb)
Left Hand Rappel Mount Provision 75801-01	7.63	120.4	918.6	-39.5	-301.4
Right Hand Rappel Mount Provision 75801-02	7.63	120.4	918.6	39.5	301.4

Metric Units		Longitudinal		Lateral	
Item	Weight (kg)	Arm (m)	Moment (kg*m)	Arm (m)	Moment (kg*m)
Left Hand Rappel Mount Provision 75801-01	3.5	3.06	10.71	-1.00	-3.5
Right Hand Rappel Mount Provision 75801-02	3.5	3.06	10.71	1.00	3.5

Note: 1. A rappeller suspended from the Rappel Mount Provision is located at Fuselage Station 113in and Right Butt Line 50in (for Right Hand Rappel Mount Provision) and/or Left Butt Line -50in (for Left Hand Rappel Mount Provision).

2. The weight and balance values above are to be used if the Rappel Mount is installed in accordance with Drawing 75801. If the Rappel Mount is installed with a Cargo Arm in accordance with Drawing 79201, then the above weight and balance values are superseded by the weight and balance values found in RFMS792.90.

DOCUMENT CONTROL LIST

DOCUMENT NO.	DOCUMENT CONTENT	REVISION
INSTALLATION DOCUMENTS		
79201	Cargo Deployment Arm Installation	2
ICA758.90	Instructions for Continued Airworthiness	2
FMS792.90	Flight Manual Supplement	2
FMS758.90	Flight Manual Supplement	2
FABRICATION DOCUMENTS		
DCL792-2	Document Control List Cargo Arm Assembly	2
ENGINEERING DOCUMENTS		
<div style="display: flex; justify-content: space-between; align-items: flex-start; padding: 10px;"> <div style="width: 30%;"> <p>APPROVAL:</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <div style="display: inline-block; text-align: center;"> <div style="font-size: 0.8em; line-height: 1;">Transport Canada Transports Canada</div> <div style="font-weight: bold; font-size: 0.8em;">AIRCRAFT CERTIFICATION DIVISION</div> <div style="font-weight: bold; font-size: 1.2em; margin: 5px 0;">APPROVED</div> <div style="font-size: 0.8em;">By: <u>[Signature]</u></div> <div style="font-size: 0.8em;">Appr'l No. <u>SH09-2</u></div> <div style="font-size: 0.8em;">Appr'l Date <u>2009-01-22</u></div> <div style="font-size: 0.8em;">Issue No. <u>1</u></div> <div style="font-size: 0.8em;">Issue Date <u>2009-01-22</u></div> <div style="font-size: 0.7em; margin-top: 5px;">YY-MM-DD</div> </div> </div> </div> <div style="width: 35%;"> <p>ORIGINAL DATE: 07 May 2008</p> <p>REVISION DATE: 14 January 2009</p> <p>SHEET 1 OF 1</p> </div> <div style="width: 30%;"> <p>AERO DESIGN LTD. 2013 - 39th Ave NE, Calgary, Alberta, T2E 6R7 Ph. (403) 250-8027 Fax. (403) 250-8333</p> <p>Bell 212, 412, 205A-1, 205B Cargo Deployment Arm Installation</p> </div> </div>		
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DOCUMENT CONTROL LIST

DOCUMENT NO.	DOCUMENT CONTENT	REVISION
INSTALLATION DOCUMENTS		
 FABRICATION DOCUMENTS		
79220	Cargo Deployment Arm Assembly	2
79230	Cargo Arm	1
79231	Bearing Sleeve	1
79232	Cover	1
79233	Bushing	0
79234	Sleeve	0
79235	Lock Leaver	1
79236	Bushing	1
79237	Bushings	1
79221	Cover	0
80120	Bracket	1
79238	Placards	0
 ENGINEERING DOCUMENTS		
ER758.01	Engineering Report	0
ER801.01	Engineering Report	0
ER808.01	Engineering Report	0

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SHEET 1 OF 1		<div style="text-align: center;"> Bell 212, 412, 205A-1, 205B Cargo Deployment Arm Assembly </div>	
<div style="font-size: 2em; font-weight: bold;">DCL792-2</div>		Rev. <div style="font-size: 2em; font-weight: bold; text-align: center;">2</div>	

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FMS792.90

BELL 212, 412, 205A-1, 205B

ROTORCRAFT FLIGHT MANUAL SUPPLEMENT

for the

INSTALLATION of the CARGO DEPLOYMENT ARM

Supplemental Type Certificate No. SH09-2

Sections 1, 2, 3 and 4 of this document comprise the Transport Canada Approved sections of this Flight Manual Supplement. Compliance with Section 1, Limitations, is mandatory.

Section 5 and any subsequent sections if present are Unapproved and are provided for information only.

The information and data contained in this Flight Manual Supplement supersede or supplement that contained in the basic Approved Flight Manual for the 212, 412, 205A-1 and 205B when fitted with the Cargo Deployment Arm. For limitations, procedures and performance not listed in this Flight Manual Supplement, refer to the Approved Flight Manual and other approved Flight Manual Supplements.



AERO DESIGN LTD.

FMS792.90

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2	Normal Procedures	5
3	Emergency Procedures	8
4	Performance	8
5	Weight and Balance	9

Revision 2
30 December 2008

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TRANSPORT CANADA APPROVED

JAN 22 2009

1 LIMITATIONS

1-3 TYPES OF OPERATIONS:

The Cargo Deployment Arm is an approved provision for non-human, cargo deployment only.

Cargo Deployment operations permitted during VFR conditions only.

1-4 FLIGHT CREW:

Cargo Deployment Operations:

A second crewman to operate the cargo deployment arm is required if cargo deployment operations are to be conducted. The crewman must have full access of the cabin to perform duties as a Cargo Deployment Operations Load Master.

All cargo deployment crew members must wear a protective helmet for moving about in the aircraft.

Carriage of Passengers during non-cargo deployment flights:

All passengers must remain seated with the seatbelt fastened during flight.

JAN 22 2009

1-5 CONFIGURATION:

The aircraft may be equipped with:

A Left Hand Cargo Deployment Arm,

A Right Hand Cargo Deployment Arm, or

Both Left Hand and Right Hand Cargo Deployment Arm.

The sideward facing seats on the left hand side must be removed if the Cargo Deployment Arm is installed on the left hand side of the helicopter.

The sideward facing seats on the right hand side must be removed if the Cargo Deployment Arm is installed on the right hand side of the helicopter.

1-5-A REQUIRED EQUIPMENT FOR CARGO DEPLOYMENT OPERATIONS:

The aircraft must have a functioning communications system between the pilot and the load master.

A hook knife must be;

- i. Carried by the Cargo Deployment Operations Load Master for immediate access, or
- ii. Fixed within the helicopter interior, readily accessible to the Cargo Deployment Operations Load Master, as detail by the operating agency's operating procedures.

1-7 AIRSPEED

Cargo Deployment Operations: Hover with lateral translation at a speed not to exceed 10 knots is permitted for positioning only.

JAN 22 2009

AERO DESIGN LTD.

FMS792.90

1-20 MARKINGS AND PLACARDS

Placards 79228-01 and 79228-02 to be in clear view of the pilot

**AIRCRAFT MUST BE IN HOVER FOR
CARGO DEPLOYMENT OPERATIONS**

Placard 79228-01

**CARGO DEPLOYMENT OPERATIONS
DURING VFR CONDITIONS ONLY**

Placard 79228-02

The following placard is engraved onto both sides of the Cargo
Deployment Arm.

**MAXIMUM CARGO DEPLOYMENT ARM
CAPACITY
250 LB (113.3 KG)**

JAN 22 2009

2 NORMAL PROCEDURES

2-1 INTRODUCTION:

The Cargo Deployment Arm is approved for non-human cargo deployment operations only. A cargo deployment operation is the continuous controlled decent of cargo from the aircraft to the ground. The cargo is fixed to a suspension line. The suspension line passes through a decent control device, such as a sky-genie or figure-of-eight. The decent of the cargo is controlled by the load master holding the "loose-end" of the suspension line within the cabin of the helicopter.

This section contains instructions for conducting cargo deployment operations.

WARNING

THE CARGO DEPLOYMENT LOAD MASTER SHOULD NOT STOP THE DECENT OF CARGO PRIOR TO REACHING THE GROUND UNLESS THE OPERATIONAL CONDITIONS CHANGE DURING THE DECENT AND REQUIRE THE LOAD MASTER TO DO SO.

WARNING

USING THE CARGO DEPLOYMENT ARM FOR EXTRACTIONS IS NOT PERMITTED.

WARNING

USING THE CARGO DEPLOYMENT ARM FOR HUMAN EXTERNAL CARGO OPERATIONS IS NOT PERMITTED.

JAN 22 2009

2-3 PREFLIGHT CHECK:

Visually inspect the Cargo Deployment Arm for loose fasteners and wear.

Ensure the roof and floor fittings are properly in position and locked.

2-9 IN FLIGHT OPERATIONS – CARGO DEPLOYMENT OPERATIONS:

Ensure communication between the pilot and the load master is established and maintained.

WARNING

**STOP CARGO DEPLOYMENT
OPERATIONS IF COMMUNICATION
BETWEEN THE PILOT AND THE LOAD
MASTER HAS FAILED**

Cargo deployment operations may commence only on the pilot's command

Cargo deployment operations must stop on the pilot's command.

The aircraft must be in hover flight during cargo deployment operations

The cargo deployment line must be dropped to the ground when the cargo deployment operation is complete. Do not retract the cargo deployment line into the aircraft.

JAN 22 2009

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FMS792.90

The load master must observe the cargo deployment operation and communicate to the pilot the status of the cargo deployment operation continuously.

3 EMERGENCY PROCEDURES

Suspension line jettisonability lies within the direct control of the load master under the pilots command. Clear communication between the pilot and the load master must be maintained during cargo deployment operations.

SUSPENSION LINE JETTISON PROCEDURE

On the command of the pilot the load master must jettison the suspension line by:

- i. Releasing the suspension line, or
- ii. Cutting the line with the hook knife provided for the Cargo Deployment Load Master.

WARNING

**THE SUSPENSION LINE MUST BE CUT
AS SHORT AS PRACTICAL.**

**ANY LOOSE LINE REMAINING MUST BE
IMMEDIATELY SECURED TO PREVENT
ANY POSSIBLE ENTANGLEMENT WITH
THE HELICOPTER ROTOR SYSTEM.**

4 PERFORMANCE

No change from basic Rotorcraft Flight Manual.

JAN 22 2009

5 WEIGHT AND BALANCE


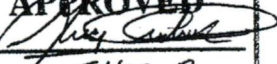
English Units		Longitudinal		Lateral	
Item	Weight (Lb)	Arm (in)	Moment (in*Lb)	Arm (in)	Moment (in*Lb)
Left Hand Cargo Deployment Arm 79201-01	12.23	126.0	1541.0	-39.5	-483.1
Right Hand Cargo Deployment Arm 79201-02	12.23	126.0	1541.0	39.5	483.1

Metric Units		Longitudinal		Lateral	
Item	Weight (kg)	Arm (m)	Moment (kg*m)	Arm (m)	Moment (kg*m)
Left Hand Cargo Deployment Arm 79201-01	5.5	3.2	17.6	-1.0	-5.5
Right Hand Cargo Deployment Arm 79201-02	5.5	3.2	17.6	1.0	5.5


Note: 1. Cargo suspended from the Cargo Deployment Arm is located at Fuselage Station 131in and Right Butt Line 57.5in (for Right Hand Cargo Deployment Arm) and/or Left Butt Line -57.5in (for Left Hand Cargo Deployment Arm).

2. The above weight and balance values supersede the weight and balance values in RFMS758.90.


DOCUMENT CONTROL LIST

DOCUMENT NO.	DOCUMENT CONTENT	REVISION
INSTALLATION DOCUMENTS		
79801	Rappel Step Installation	0
ICA758.90	Instructions for Continued Airworthiness	2
FABRICATION DOCUMENTS		
DCL798-2	Document Control List Rappel Step Assembly	1
ENGINEERING DOCUMENTS		
APPROVAL:		
 <div style="display: flex; justify-content: space-between;"> <div>Transport Canada</div> <div>Transports Canada</div> </div> <div style="text-align: center;"> AIRCRAFT CERTIFICATION DIVISION APPROVED By:  Appr'l No. <u>SH09-2</u> Appr'l Date <u>2009-01-22</u> Issue No. <u>1</u> Issue Date <u>2009-01-22</u> <small>YY - MM - DD</small> </div>	ORIGINAL DATE: 14 May 2008	AERO DESIGN LTD. 2013 - 39 th Ave NE, Calgary, Alberta, T2E 6R7 Ph. (403) 250-8027 Fax. (403) 250-8333
	REVISION DATE: 14 January 2009	
	SHEET 1 OF 1	Rev.
	DCL798-1	

DOCUMENT CONTROL LIST

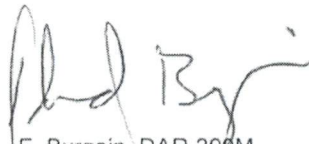
DOCUMENT NO.	DOCUMENT CONTENT	REVISION
INSTALLATION DOCUMENTS		
FABRICATION DOCUMENTS		
79820	Rappel Step Assembly	0
79830	Step	1
79831	Mounting Plate STN 84	1
79832	Mounting Plate STN 129	1
79833	Block	1
79834	Kick Plate	1
79835	Bushing	1
78230	Step Extrusion	1
ENGINEERING DOCUMENTS		
ER758.01	Engineering Report	0
TP798.02	Test Plan/Report	0
APPROVAL:		
<div style="display: flex; justify-content: space-between;"> <div style="width: 30%;">  <p>Transport Canada Transports Canada</p> <p>AIRCRAFT CERTIFICATION DIVISION</p> <p>APPROVED</p> <p>By: <i>[Signature]</i></p> <p>Appr'l No. <u>SH09-2</u></p> <p>Appr'l Date <u>2009-01-22</u></p> <p>Issue No. <u>1</u></p> <p>Issue Date <u>2009-01-22</u></p> <p style="text-align: center;">YY - MM - DD</p> </div> <div style="width: 40%;"> <p>ORIGINAL DATE: 14 May 2008</p> <p>REVISION DATE: 14 January 2009</p> </div> <div style="width: 30%; text-align: center;"> <p>AERO DESIGN LTD.</p> <p>2013 - 39th Ave NE, Calgary, Alberta, T2E 6R7</p> <p>Ph. (403) 250-8027</p> <p>Fax. (403) 250-8333</p> </div> </div>		
SHEET 1 OF 1		<p>Bell 212, 412, 205A-1, 205B</p> <p>Rappel Step Assembly</p>
DCL798-2		<p>Rev.</p> <p style="font-size: 2em; font-weight: bold;">1</p>

FORM AE-100

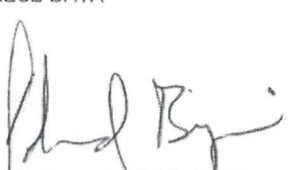
DEPARTMENT OF TRANSPORT STATEMENT OF COMPLIANCE OF AIRCRAFT OR AIRCRAFT COMPONENTS WITH THE AIRWORTHINESS REQUIREMENTS		AE-100 No.: AE808-1 Initial Issue Date: 14 January 2009 Revision: 0 Revision Date: Approval No.: <i>SH09-2</i> Delegation No.: 290M Delegate Name: E. Burgoin Classification of Designee: AERO Design Ltd. Employer:	
Aircraft Mfr: Bell Aircraft Model: 212, 412, 205A-1, 205B Registration: All eligible	Model Type Airplane <input type="checkbox"/> Helicopter <input checked="" type="checkbox"/> Appliance <input type="checkbox"/> Component <input type="checkbox"/>		
LIST OF APPROVED REPORTS AND DATA			
Document Number	Document Title		Compliance Status
			As per Compliance CP758-1 Rev 1 CP758-2 Rev 2
DATA APPROVED BY TRANSPORT CANADA			
FMS758 FMS792	Revision 2 Revision 2	Flight Manual Supplement Flight Manual Supplement	
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 E. Burgoin, DAR 290M			

AE100, 27 February, 2003


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DEPARTMENT OF TRANSPORT STATEMENT OF COMPLIANCE OF AIRCRAFT OR AIRCRAFT COMPONENTS WITH THE AIRWORTHINESS REQUIREMENTS			AE-100 No.: AE808-2 Initial Issue Date: 14 January 2009 Revision: 0 Revision Date: Approval No.: SH09-2 Delegation No.: 290M Delegate Name: E. Burgoin Classification of Designee: Employer: AERO Design Ltd.	
Aircraft Mfr: Bell Helicopters Aircraft Model: 212, 412, 205A-1, 205B Registration: ALL ELIGIBLE	Model Type Airplane <input type="checkbox"/> Helicopter <input checked="" type="checkbox"/> Appliance <input type="checkbox"/> Component <input type="checkbox"/>			
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DCL758-1 75801	Revision 3 Revision 1	Document Control List Rappel Mount Provision Installation	As per Compliance CP758-2 Rev 2	
DCL758-2 75820	Revision 2 Revision 1	Document Control List Rappel Mount Assembly		
75824	Revision 2	Assembly, Plug, STN 105		
75825	Revision 2	Assembly, Plug, Guide		
75826	Revision 2	Assembly, Plug, 131		
75830	Revision 1	Tube		
75831	Revision 1	Retainer		
75832	Revision 1	Guide		
75833	Revision 1	Stanchion Adapter		
75834	Revision 1	Curved Washer		
75835	Revision 1	Gate Parts		
75837	Revision 0	Placards		
75821	Revision 0	Assembly, Guard Ring		
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ER758.01	Revision 0	Engineering Report		
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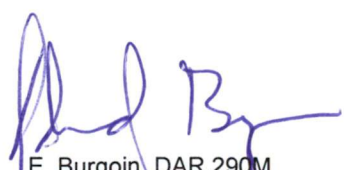
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DEPARTMENT OF TRANSPORT STATEMENT OF COMPLIANCE OF AIRCRAFT OR AIRCRAFT COMPONENTS WITH THE AIRWORTHINESS REQUIREMENTS			AE-100 No.: AE808-3 Initial Issue Date: 14 January 2009 Revision: 0 Revision Date: Approval No.: SH09-2 Delegation No.: 290M Delegate Name: E. Burgoin Classification of Designee: Employer: AERO Design Ltd.	
Aircraft Mfr: Bell Helicopters Aircraft Model: 212, 412, 205A-1, 205B Registration: ALL ELIGIBLE	Model Type Airplane <input type="checkbox"/> Helicopter <input checked="" type="checkbox"/> Appliance <input type="checkbox"/> Component <input type="checkbox"/>			
LIST OF APPROVED REPORTS AND DATA				
Document Number		Document Title	Compliance Status	
DCL792-1 79201	Revision 3 Revision 2	Document Control List Cargo Deployment Arm Installation	As per Compliance CP758-1 Rev 1	
DCL792-2 79220	Revision 2	Document Control List		
79230	Revision 2	Cargo Deployment Arm Assembly		
79231	Revision 1	Cargo Arm		
79232	Revision 1	Bearing Sleeve		
79233	Revision 1	Cover		
79234	Revision 0	Bushing		
79235	Revision 0	Sleeve		
79236	Revision 1	Lock Leaver		
79237	Revision 1	Bushing		
79238	Revision 1	Bushings		
79221	Revision 0	Placards		
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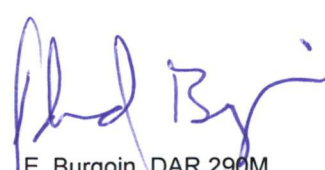
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Aircraft Mfr: Bell Helicopters Aircraft Model: 212, 412, 205A-1, 205B Registration: ALL ELIGIBLE	Model Type Airplane <input type="checkbox"/> Helicopter <input checked="" type="checkbox"/> Appliance <input type="checkbox"/> Component <input type="checkbox"/>			
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DCL798-2 79820 79830 79831 79832 79833 79834 79835 78230	Revision 1 Revision 0 Revision 1 Revision 1 Revision 1 Revision 1 Revision 1 Revision 1 Revision 1	Document Control List Rappel Step Assembly Step Mounting Plate Stn 84 Mounting Plate Stn 129 Block Kick Plate Bushing Step Extrusion		
ER758.01 ER808.01 TP798.02	Revision 0 Revision 0 Revision 0	Engineering Report Engineering Report Test Plan/Report (Flight)		
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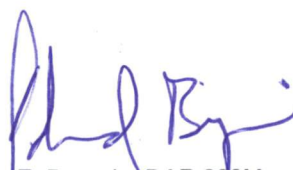
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Aircraft Mfr: Bell Aircraft Model: 212, 412, 205A-1, 205B Registration: All eligible	Model Type Airplane <input type="checkbox"/> Helicopter <input checked="" type="checkbox"/> Appliance <input type="checkbox"/> Component <input type="checkbox"/>		
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Document Number		Document Title	Compliance Status As per Compliance CP758-1 Rev 1 CP758-2 Rev 2
		DATA APPROVED BY TRANSPORT CANADA	
FMS758 FMS792	Revision 2 Revision 2	Flight Manual Supplement Flight Manual Supplement	
CERTIFICATION			
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 E. Burgoin, DAR 290M			


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<p>DEPARTMENT OF TRANSPORT STATEMENT OF COMPLIANCE OF AIRCRAFT OR AIRCRAFT COMPONENTS WITH THE AIRWORTHINESS REQUIREMENTS</p>		<p>AE-100 No.: AE808-2 Initial Issue Date: 14 January 2009</p>	
<p>Aircraft Mfr: Bell Helicopters Aircraft Model: 212, 412, 205A-1, 205B Registration: ALL ELIGIBLE</p>		<p>Model Type Airplane <input type="checkbox"/> Helicopter <input checked="" type="checkbox"/> Appliance <input type="checkbox"/> Component <input type="checkbox"/></p>	
		<p>Revision: 0 Revision Date: Approval No.: 5109-2 Delegation No.: 290M Delegate Name: E. Burgoin Classification of Designee: Employer: AERO Design Ltd.</p>	
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<p>Aircraft Mfr: Bell Helicopters Aircraft Model: 212, 412, 205A-1, 205B Registration: ALL ELIGIBLE</p>		<p>Model Type Airplane <input type="checkbox"/> Helicopter <input checked="" type="checkbox"/> Appliance <input type="checkbox"/> Component <input type="checkbox"/></p>	
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Aircraft Mfr: Bell Helicopters Aircraft Model: 212, 412, 205A-1, 205B Registration: ALL ELIGIBLE	Model Type Airplane <input type="checkbox"/> Helicopter <input checked="" type="checkbox"/> Appliance <input type="checkbox"/> Component <input type="checkbox"/>		
LIST OF APPROVED REPORTS AND DATA			
Document Number		Document Title	Compliance Status
DCL798-1 79801	Revision 2 Revision 0	Document Control List Rappel Step Installation	As per Compliance CP798 Rev 0
DCL798-2 79820 79830 79831 79832 79833 79834 79835 78230	Revision 1 Revision 0 Revision 1 Revision 1 Revision 1 Revision 1 Revision 1 Revision 1 Revision 1	Document Control List Rappel Step Assembly Step Mounting Plate Str 84 Mounting Plate Str 129 Block Kick Plate Bushing Step Extrusion	
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I THEREFORE <input type="checkbox"/> RECOMMEND FOR APPROVAL OF THESE DATA <input checked="" type="checkbox"/> APPROVE THESE DATA			
 E. Burgoin, DAR 290M			

Department of Transport

Supplemental Type Certificate

This approval is issued to:

AERO Design Ltd.
2013 39th Avenue NE
Calgary, Alberta
Canada T2E 6R7

Number: SH09-2

Issue No.: 1

Approval Date: January, 2009

Issue Date: January, 2009

Responsible Office:

Prairie and Northern

Aircraft/Engine Type or Model:

Bell Helicopters 212, 412, 205A-1, 205B

Registration/Serial No.:

All eligible

Canadian Type Certificate or Equivalent:

H-86

Description of Type Design Change:

Rappel Mount Provision and Cargo Deployment Arm

Installation/Operating Data, Required Equipment and Limitations:

Configuration A - Rappel Mount Provision Only:

Installation of the Rappel Mount Provision to be completed in accordance with Transport Canada approved, AERO Design Ltd. Document Control List, DCL758-1, Revision 3, dated 14 January 2009, or later approved revision.

Transport Canada approved, AERO Design Ltd. Flight Manual Supplement FMS758.90, Revision 2, dated 30 December, 2008, or later approved revision is required with this installation.

Configuration B - Rappel Mount Provision with Cargo Deployment Arm:

Installation of the Rappel Mount Provision and Cargo Deployment Arm to be completed in accordance with Transport Canada approved, AERO Design Ltd. Document Control List, DCL792-1, Revision 3, dated 14 January 2009, or later approved revision.

Transport Canada approved, AERO Design Ltd. Flight Manual Supplement FMS758.90, Revision 2, dated 30 December, 2008, and Transport Canada approved, AERO Design Ltd. Flight Manual Supplement FMS792.90, Revision 2, dated 30 December, 2008, or later approved revision is required with this installation

Conditions: This approval is only applicable to the type/model of aeronautical product specified therein. Prior to incorporating this modification, the installer shall establish that the interrelationship between this change and any other modification(s) incorporated **will not** adversely affect the airworthiness of the modified product.

For Minister of Transport

Draft Copy.

Emailed to G. L.

NOTE: THIS ADDENDUM SHALL REMAIN PART OF THE CERTIFICATE REFERRED TO THEREIN.

Optional Equipment Installation to Configuration A and B:

Installation of the Rappel step is optional to Configuration A and B. The Installation of the Rappel Step to be completed in accordance with Transport Canada approved, AERO Design Ltd. Document Control List, DCL798-1, Revision 2, dated 14 January 2009, or later approved revision.

Data Pertinent to All Configurations:

Transport Canada accepted, AERO Design Ltd. Instructions for Continued Airworthiness ICA758.90, Revision 2, dated 30 December, 2008, or later accepted revision is required with this installation.

Basis of Certification for installation is FAR 29 at amendment 29-2 and amendment 29-43 for 29.865(a) and 29.865(e).

— End —

AERO Design Ltd.

**ENGINEERING REPORT
ER758.01**

**Rappel Mount Provision
Cargo Deployment Arm
Rappel Step**

Bell 412, 212, 205A-1, 205B

Copy.

Approved by: E. Burgoin, P. Eng.

Prepared by: Richard Rathwell

Revision 0
Date: 08 April, 2008

AERO Design Ltd.
Engineering Consultants

2013 – 39th Avenue N.E., Calgary, Alberta T2E 6R7
Phone: (403) 250-8027
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E-Mail: info@aerodesign.ca

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1.0 INTRODUCTION

This document will show elements the installation of the Rappel Mounting Provision and the Cargo Deployment Arm are in compliance with Federal Aviation Regulations detailed in the Aero Design Ltd. Document CP758-1, *Compliance Program* and Aero Design Ltd. Document CP758-2, *Compliance Program*

The installation provides an aircraft mount for rappelling operations and cargo deployment operations by trained personnel (ie. rappelling fire fighters).

2.0 REFERENCE

AERO Design Ltd. Drawing 75801 Rappel Mount Provision
AERO Design Ltd. Drawing 79201 Cargo Deployment Arm
AERO Design Ltd. Drawing 79801 Rappel Step
AERO Design Ltd. Document CP758-01 *Compliance Program*
AERO Design Ltd. Document CP758-02 *Compliance Program*
AERO Design Ltd. Document CP798 *Compliance Program*
Bell Helicopters RPT-205-099-205
USAAVLABS Technical Report 70-22, Crash Survival Design Guide
USAAVSCOM Technical Report 89-D-22B Aircraft Crash Survival Design Guide, Volume II
Analysis and Design of Flight Vehicle Structures, Bruhn
Fluid Dynamic Drag, Hoerner
MIL-STD-1472D, Human Engineering Design Criteria for Military Systems, Equipment and Facilities

3.0 BASIS OF CERTIFICATION

Bell 412: FAR Part 29 dated 1 February 1965, Amendment 29-1 and 29-2
Bell 212: FAR Part 29 dated 1 February 1965, Amendment 29-1 and 29-2
Bell 205A-1: CAR 7 dated August 1, 1956, Amendments 7-1 through 7-4
Bell 205B: CAR 7 dated August 1, 1956, Amendments 7-1 through 7-4
This installation: FAR Part 29 dated 1 February 1965, Amendment 29-1 and 29-2 and Amendment 29-43 for 29.865(a) and 29.865(e)

4.0 ANALYSIS OF CURRENT AIRWORTHINESS DIRECTIVES (AD'S)

There are no current AD's related to this project. Refer to appendix A of this document for a list of current AD's.

5.0 STRUCTURAL ANALYSIS – RAPPEL MOUNT PROVISION

5.1 Loads and Factors

Weight of Rappeller: Maximum weight of rappeller per FMS Limitation $W_{rap} := 350 \text{ lbf}$

Human External Load Factor: Per 29.865(a) $n_{lf} := 3.5$

Safety Factor: Per 29.303 $n_{sf} := 1.5$

Fitting Factor: Per 29.625 $n_{ff} := 1.15$

Limit Downward Load Factor:

$$n_{v_lim} := n_{lf} \cdot n_{ff} \quad n_{v_lim} = 4.02$$

Limit Downward Load of Rappeller on the Rope:

$$P_{rap_lim} := W_{rap} \cdot n_{v_lim} \quad P_{rap_lim} = 1408.7 \text{ lbf}$$

Ultimate Downward Load Factor:

$$n_{v_ult} := n_{lf} \cdot n_{sf} \cdot n_{ff} \quad n_{v_ult} = 6.04$$

Ultimate Downward Load of Rappeller on the Rope:

$$P_{rap_ult} := W_{rap} \cdot n_{v_ult} \quad P_{rap_ult} = 2113.1 \text{ lbf}$$

5.2 Reactions

Reactions - At Rope Guide (See Figure 5.2.1)

$$R_{\text{guide_lim}} := \frac{P_{\text{rap_lim}}}{\sin[(90 - 12) \cdot \text{deg}]}$$

The limit load case is used only for analyzing the combined loads on the rappel tube.

$$R_{\text{guide_lim}} = 1440.2 \text{ lbf}$$

$$R_{\text{guide}} := \frac{P_{\text{rap_ult}}}{\sin[(90 - 12) \cdot \text{deg}]}$$

Ultimate load case

$$R_{\text{guide}} = 2160.3 \text{ lbf}$$

$$R_{\text{h_guide}} := R_{\text{guide}} \cdot \sin(12 \cdot \text{deg})$$

$$R_{\text{h_guide}} = 449.2 \text{ lbf}$$

$$R_{\text{v_guide}} := R_{\text{guide}} \cdot \cos(12 \cdot \text{deg})$$

$$R_{\text{v_guide}} = 2113.1 \text{ lbf}$$

Reactions - Sill

$$R_{\text{sill}} := R_{\text{h_guide}}$$

$$R_{\text{sill}} = 449.2 \text{ lbf}$$

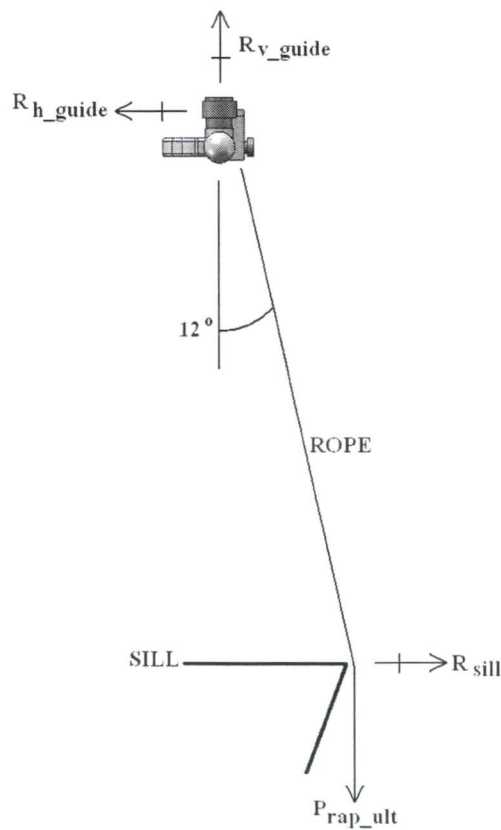


Figure 5.2.1

Reactions - Aircraft Roof Fittings

Roof Fitting Allowables Per Bell Helicopters RPT-205-099-205:

Floor Fitting 30 - Vertical:

$$F_{v_FF30} := 2150 \cdot \text{lbf}$$

Floor Fitting 30 - Longitudinal:

$$F_{\text{long_FF30}} := 2150 \cdot \text{lbf}$$

Floor Fitting 30 - Lateral:

$$F_{\text{lat_FF30}} := 2150 \cdot \text{lbf}$$

Roof Fitting 5 - Vertical:

$$F_{v_RF5} := 0 \cdot \text{lbf}$$

Roof Fitting 5 - Longitudinal:

$$F_{\text{long_RF5}} := 1250 \cdot \text{lbf}$$

Roof Fitting 5 - Lateral:

$$F_{\text{lat_RF5}} := 1250 \cdot \text{lbf}$$

Roof Fitting 3 - Vertical:

$$F_{v_RF3} := 1500 \cdot \text{lbf}$$

Roof Fitting 3 - Longitudinal:

$$F_{\text{long_RF3}} := 0 \cdot \text{lbf}$$

Roof Fitting 3 - Lateral loading allowable has been rationalized with the following assumption:

Bell Helicopters Report 205-099-205 states that roof fitting #3 has an ultimate vertical load allowable of 1500 lbf. A lateral load allowable for roof fitting #3 has not been expressed for reasons unknown.

The position of this document is that an analysis of the roof fitting for a 1500 lbf lateral load, coupled with the defined vertical load allowable note above, would provide sufficient data to know the load allowable for any angle within the vertical-lateral plane.

Lateral load for analysis:

$$P_{\text{lat}} := 1500 \cdot \text{lbf}$$

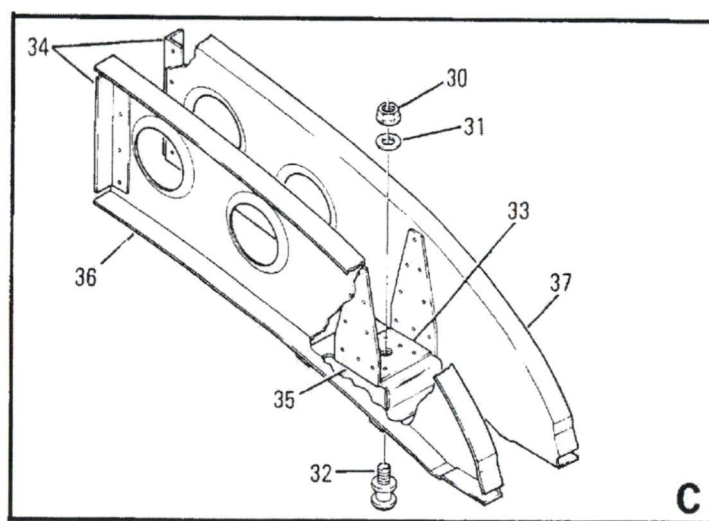


Figure 5.2.2 – Roof Fitting #3, Including Lateral Frames

Analysis of fitting plate bearing strength:

Plate thickness

$$t_{\text{plate}} := 0.090 \cdot \text{in}$$

Diameter of hole

$$D_{\text{plate}} := 0.375 \cdot \text{in}$$

Bearing Area:

$$A_{\text{plate_br}} := t_{\text{plate}} \cdot D_{\text{plate}}$$

$$A_{\text{plate_br}} = 0.034 \text{ in}^2$$

Stress:

$$\sigma_{\text{plate}} := \frac{P_{\text{lat}}}{A_{\text{plate_br}}}$$

$$\sigma_{\text{plate}} = 44 \text{ ksi}$$

Material Prop. 2024-T3 (bearing)

$$F_{\text{bru_2024}} := 104 \cdot \text{ksi}$$

Margin of Safety:

$$MS_{\sigma_{\text{plate}}} := \frac{F_{\text{bru_2024}}}{\sigma_{\text{plate}}} - 1$$

$$MS_{\sigma_{\text{plate}}} = 1.3$$

MARGIN OF SAFETY IS POSITIVE

Analysis of fitting in shear:

Plate height

$$h_{\text{plate}} := 0.090 \cdot \text{in}$$

Plate Length

$$l_{\text{plate}} := 1.625 \cdot \text{in}$$

Shear Area (2 sides)

$$A_{\text{plate_s}} := 2(h_{\text{plate}} \cdot l_{\text{plate}})$$

$$A_{\text{plate_s}} = 0.29 \text{ in}^2$$

Stress:

$$\tau_{\text{plate}} := \frac{P_{\text{lat}}}{A_{\text{plate_s}}}$$

$$\tau_{\text{plate}} = 5.13 \text{ ksi}$$

Material Prop. 2024-T3 (shear)

$$F_{\text{su_2024}} := 39 \cdot \text{ksi}$$

Margin of Safety:

$$MS_{\tau_{\text{plate}}} := \frac{F_{\text{su_2024}}}{\tau_{\text{plate}}} - 1$$

$$MS_{\tau_{\text{plate}}} = 6.6$$

MARGIN OF SAFETY IS POSITIVE

Analysis of rivets:

Centrod:

(estimated by finding the average distance of the rivets from the base of the fitting bracket)

RIVET	DISTANCE FROM BASE (IN)
-------	-------------------------------

A	3.41
B	2.375
C	2.375
D	1.437
E	1.437
F	0.45
H	0.45
G	0.45

SUM OF DIST= **12.384** IN

AVG DIST OVER 8 RIVETS= **1.548** IN
(ESTIMATED CENTROID LOCATION FROM
BASE)

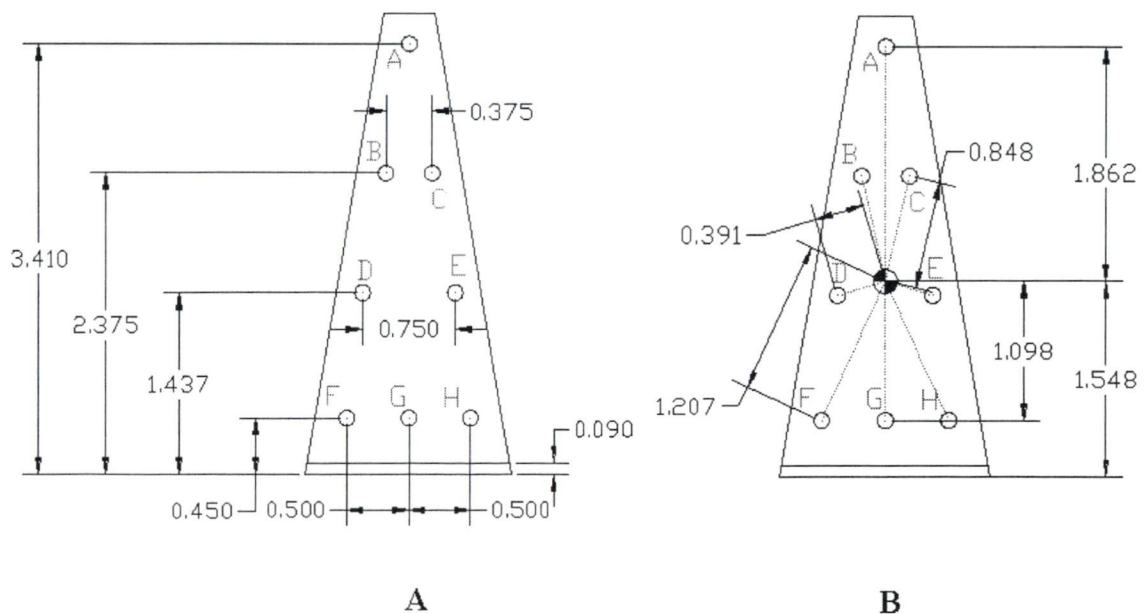
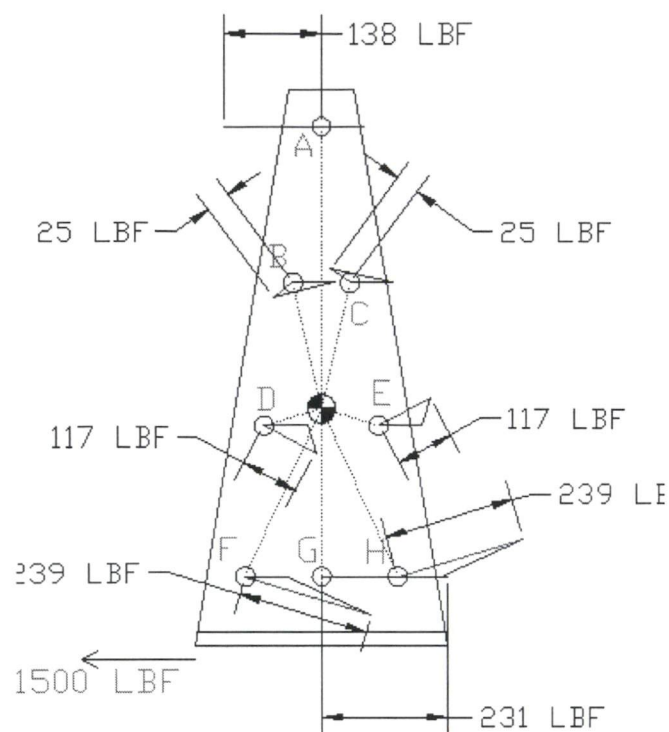


Figure 5.2.3 – Roof Fitting Bracket, Dimensions

Figure 5.2.4 shows the resolved reactions at each fitting (1500 lbf / 8 fittings and eccentric load applied to each fitting)



C

Figure 5.2.4 – Roof Fitting Bracket - Reactions

Eccentric Load Analysis, From Bruhn;

	D	D ²	M	I	F
	DISTANCE		MOMENT AT		FORCE
	FROM		CENTROID		M x D / I
RIVET	CENTROID (IN)	DIST ²	1500# X 1.55IN	I (IN ²)	(LBF)
A	1.862	3.47	1162.5	9.33	232
B	0.848	0.72	1162.5	9.33	106
C	0.848	0.72	1162.5	9.33	106
D	0.391	0.15	1162.5	9.33	49
E	0.391	0.15	1162.5	9.33	49
F	1.206	1.45	1162.5	9.33	150
H	1.206	1.45	1162.5	9.33	150
G	1.098	1.21	1162.5	9.33	137

SUM OF DIST², I = 9.33 IN²

The critical load is at rivet "F" and "H" (equal)

$$P_{\text{riv_critical}} := 239 \cdot \text{lbf}$$

Material Prop. 1/8 "AD4" Rivet (shear)

$$F_{\text{su_AD4}} := 389 \cdot \text{lbf}$$

Margin of Safety:

$$MS_{\text{riv_critical}} := \frac{F_{\text{su_AD4}}}{P_{\text{riv_critical}}} - 1$$

$$MS_{\text{riv_critical}} = 0.6$$

MARGIN OF SAFETY IS POSITIVE

Analysis of Lateral Frame

Material Prop. of Lateral Frame:

Bearing Strength, 2024-T3

$$F_{\text{bru_2024}} := 104 \cdot \text{ksi}$$

Thickness

$$T_{\text{frame}} := 0.025 \cdot \text{in}$$

Diameter of Rivet Hole (AD4 No. 30 Drill)

$$D_{\text{AD4}} := 0.1285 \cdot \text{in}$$

Bearing Area:

$$A_{\text{br_frame}} := D_{\text{AD4}} \cdot T_{\text{frame}}$$

$$A_{\text{br_frame}} = 0.0032 \cdot \text{in}^2$$

Stress :

$$\sigma_{\text{frame}} := \frac{P_{\text{riv_critical}}}{A_{\text{br_frame}}}$$

$$\sigma_{\text{frame}} = 74396.9 \cdot \text{psi}$$

Margin of Safety:

$$MS_{\text{frame}} := \frac{F_{\text{bru_2024}}}{\sigma_{\text{frame}}} - 1$$

$$MS_{\text{frame}} = 0.4$$

MARGIN OF SAFETY IS POSITIVE

The lateral frames for roof fitting #3 are identical to the lateral frames for roof fitting #5 and #6. These frames are similar in material type, thickness, general shape and attachment to the same cabin roof longitudinal frame assembly. Roof fitting #5 and #6 share a single pair of lateral frames, with a combined lateral ultimate load allowable of 2500 lbf. Therefore, by comparison, the lateral frames are sufficient to carry the 1500 lbf ultimate lateral load. Furthermore, the cabin roof longitudinal frame assembly would also carry the 1500 lbf ultimate lateral load by the same comparison. See Figure 5.2.5.

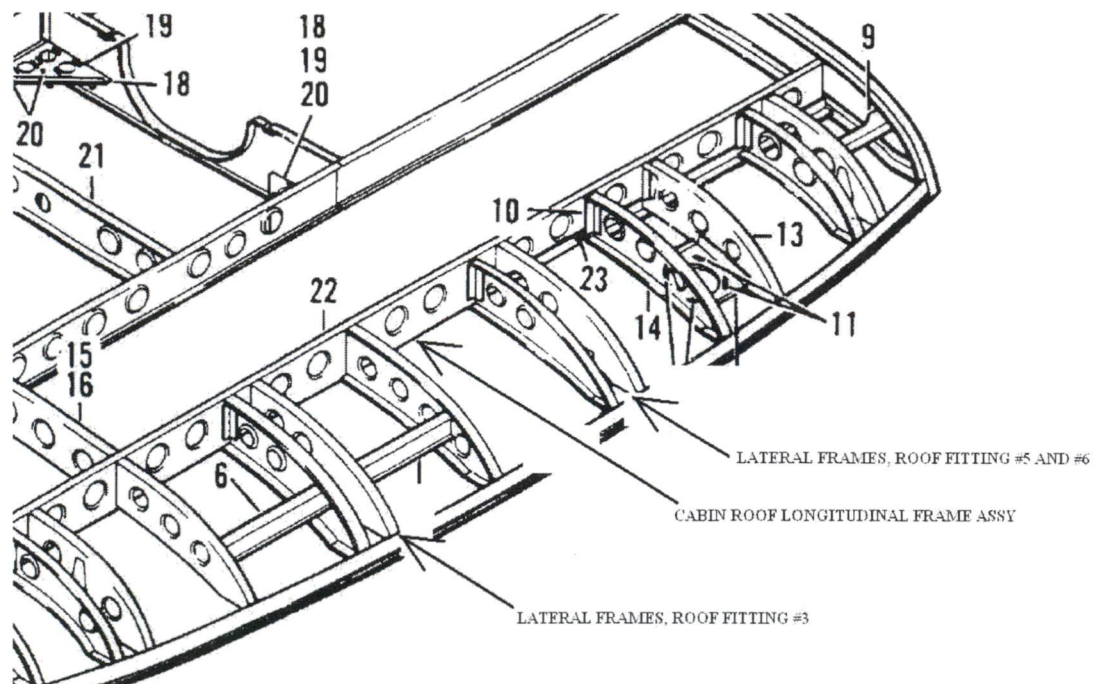


Figure 5.2.5 – Roof Assembly

Vertical Reactions (See Figure 5.2.6)

Assumption : Floor Fitting 30 and Roof Fitting 3 take all vertical loads.

Roof Fitting 3

$$R_{v_RF3} := \frac{R_{v_guide} \cdot 18.0 \cdot \text{in}}{25.9 \cdot \text{in}}$$

$$R_{v_RF3} = 1468.61 \text{ lbf}$$

Margin of Safety:

$$MS_{v_RF3} := \frac{F_{v_RF3}}{R_{v_RF3}} - 1$$

$$MS_{v_RF3} = 0.021$$

MARGIN OF SAFETY IS POSITIVE

Floor Fitting 30

$$R_{v_FF30} := \frac{R_{v_guide} \cdot 7.9 \cdot \text{in}}{25.9 \cdot \text{in}}$$

$$R_{v_FF30} = 644.51 \text{bf}$$

Margin of Safety:

$$MS_{v_FF30} := \frac{F_{v_FF30}}{R_{v_FF30}} - 1$$

$$MS_{v_FF30} = 2.336$$

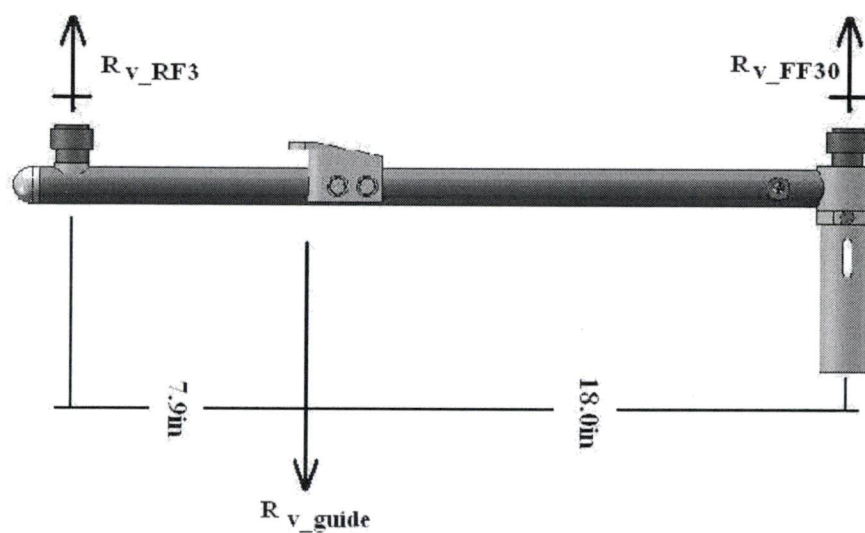
MARGIN OF SAFETY IS POSITIVE

Figure 5.2.6

Stanchion Compression:

$$OD_{stan} := 2.0 \cdot \text{in}$$

$$ID_{stan} := 1.75 \cdot \text{in}$$

Area - Stanchion

$$A_{stan} := \left(\frac{OD_{stan}}{2} \right)^2 \cdot \pi - \left(\frac{ID_{stan}}{2} \right)^2 \cdot \pi$$

$$A_{stan} = 0.7 \text{ in}^2$$

Stress:

$$\sigma_{stan_comp} := \frac{R_{v_FF30}}{A_{stan}}$$

$$\sigma_{stan_comp} = 0.9 \text{ ksi}$$

Horizontal Reactions (See Figure 5.2.7)

Assumption : Roof Fitting 3 and Roof Fitting 5 take all horizontal loads

Roof Fitting 3

$$R_{lat_RF3} := \frac{R_{h_guide} \cdot 18.0 \cdot \text{in}}{25.9 \cdot \text{in}}$$

$$R_{lat_RF3} = 312.21 \text{ bf}$$

Margin of Safety:

$$MS_{lat_RF3} := \frac{F_{lat_RF3}}{R_{lat_RF3}} - 1$$

$$MS_{lat_RF3} = 3.8$$

Roof Fitting 5

$$R_{lat_RF5} := \frac{R_{h_guide} \cdot 7.9 \text{ in}}{25.9 \text{ in}}$$

$$R_{lat_RF5} = 137 \text{ lbf}$$

Margin of Safety

$$MS_{lat_RF5} := \frac{F_{lat_RF5}}{R_{lat_RF5}} - 1$$

$$MS_{lat_RF5} = 8.1$$

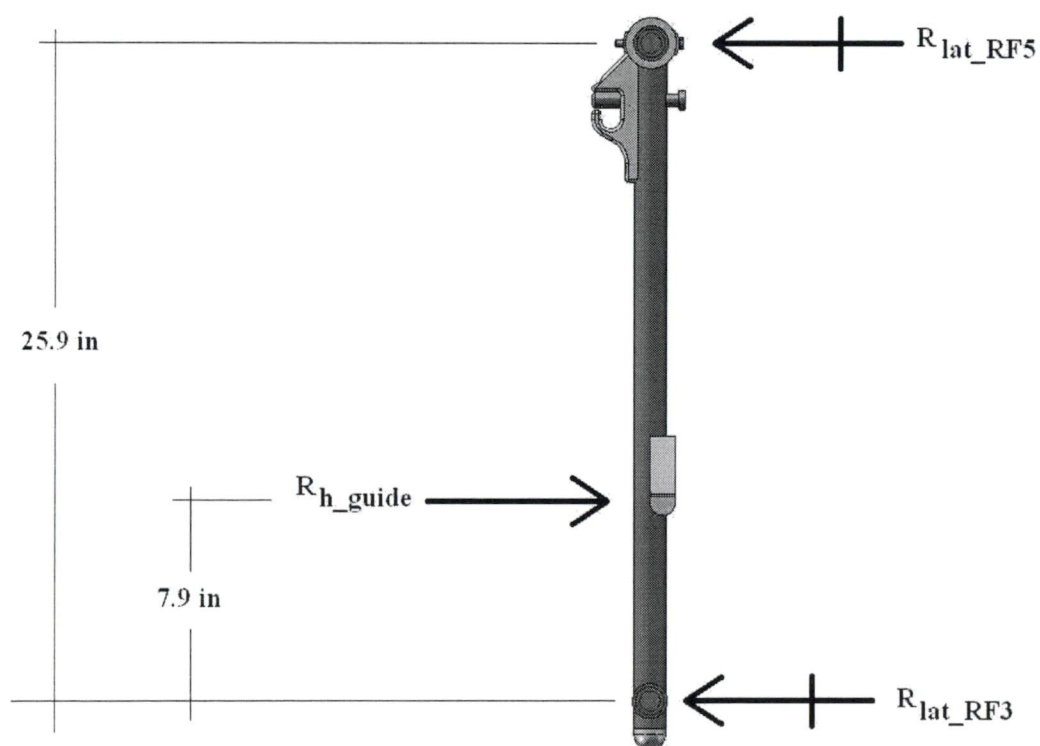
MARGIN OF SAFETY IS POSITIVE

Figure 5.2.7

Reaction - Roof Attach Fittings

Mechanical Properties of 33115 Roof Attach Fitting
- per manufacturer specs.(See Appendix C)

$$F_{v_33115} := 5475 \cdot \text{lbf}$$

$$F_{lat_33115} := 2300 \cdot \text{lbf}$$

Margin of Safety (vertical):

$$MS_{v_33115} := \left(\frac{F_{v_33115}}{R_{v_RF3}} \right) - 1$$

Critical Case

$$MS_{v_33115} = 2.7$$

MARGIN OF SAFETY IS POSITIVE

Margin of Safety (lateral):

$$MS_{lat_33115} := \left(\frac{F_{lat_33115}}{R_{lat_RF3}} \right) - 1$$

Critical Case

$$MS_{lat_33115} = 6.37$$

MARGIN OF SAFETY IS POSITIVEReaction - Tube Bending (See Figure 5.2.8).

Combined stresses occur on the rappel tube as a result of normal operation.

Figure 5.2.8 "A" shows of a moment reaction on rappel tube.

Figure 5.2.8 "B" shows the rappel tube in compression.

Figure 5.2.8 "C" shows the rappel tube in bending.

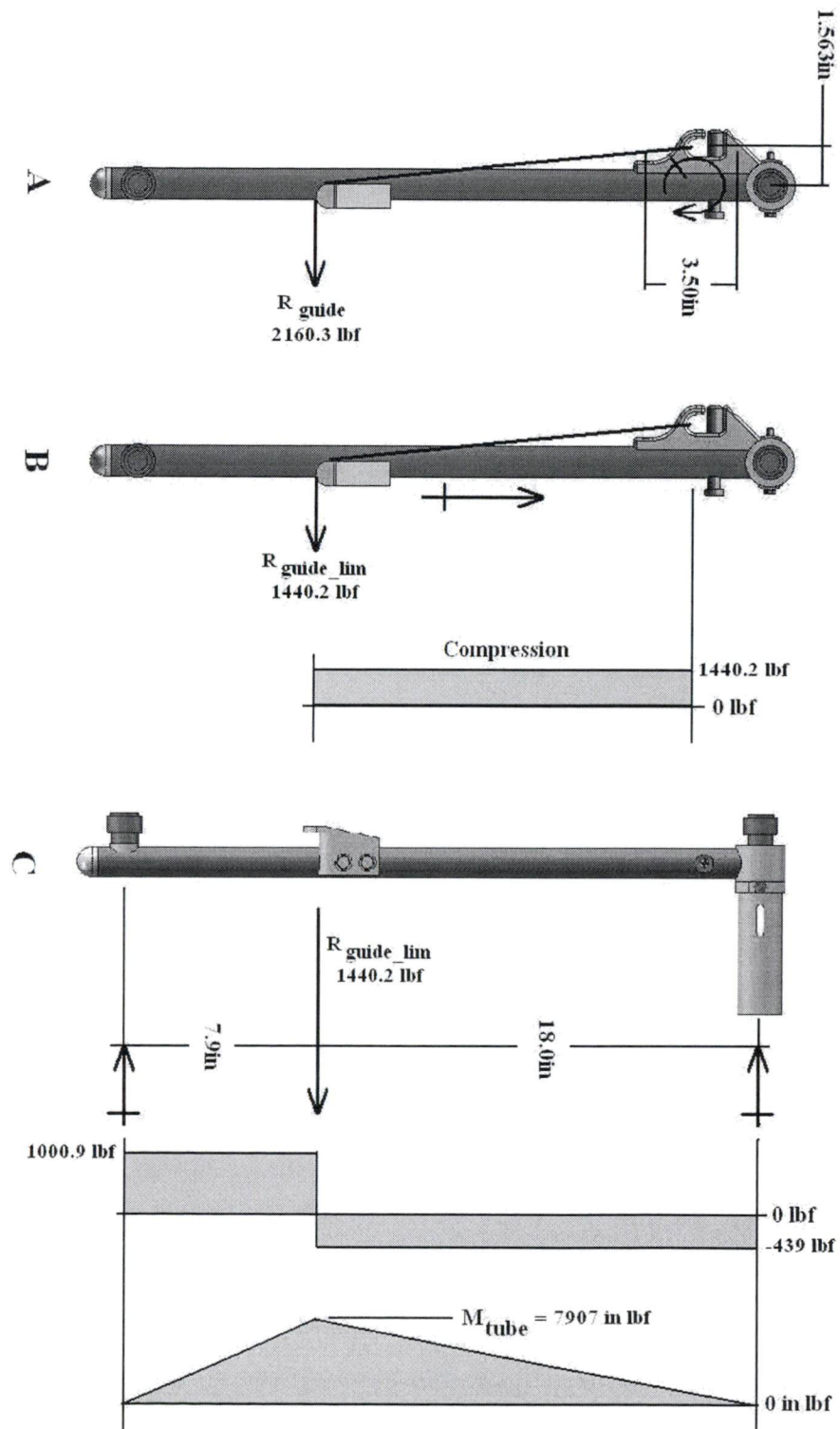


Figure 5.2.8

Moment Reaction through aft bolt (figure 5.2.8 "A"):

$$R_{AN5} := \frac{R_{\text{guide}} \cdot 1.563 \cdot \text{in}}{3.5 \cdot \text{in}}$$

$$R_{AN5} = 964.7 \text{ lbf}$$

Mechanical Properties of AN5 Bolt (tensile):

$$F_{AN5} := 6710 \cdot \text{lbf}$$

Margin of Safety:

$$MS_{AN5} := \frac{F_{AN5}}{R_{AN5}} - 1$$

$$MS_{AN5} = 6$$

MARGIN OF SAFETY IS POSITIVE

Compression (figure 5.2.8 "B"):

Area - Tube

$$A_{\text{tube}} := 0.544 \cdot \text{in}^2$$

Stress:

$$\sigma_{\text{tube_comp}} := \frac{R_{\text{guide_lim}}}{A_{\text{tube}}}$$

$$\sigma_{\text{tube_comp}} = 2.6 \text{ ksi}$$

Bending Moment (figure 5.2.8 "C"):

$$M_{\text{tube}} := \frac{R_{\text{guide_lim}} \cdot 7.9 \cdot \text{in}}{25.9 \cdot \text{in}} \cdot 18 \cdot \text{in}$$

$$M_{\text{tube}} = 7907.3 \text{ in-lbf}$$

Moment of Inertia - Tube

Per Section Properties Output Data (Solid Works)

$$I_{\text{tube}} := 0.08 \cdot \text{in}^4$$

Centroid - Tube

Per Section Properties Output Data (Solid Works)

$$c_{\text{tube}} := 0.625 \cdot \text{in}$$

Stress:

$$\sigma_{\text{tube_bend}} := \frac{M_{\text{tube}} \cdot c_{\text{tube}}}{I_{\text{tube}}}$$

$$\sigma_{\text{tube_bend}} = 61.8 \text{ ksi}$$

Combined Stresses within the tube occur at the rope guide:

$$\sigma_{\text{combined}} := \sigma_{\text{tube_bend}} + \sigma_{\text{tube_comp}}$$

$$\sigma_{\text{combined}} = 64.423 \text{ ksi}$$

Mechanical Properties of 4130N Steel
Per MMPDS-01

$$F_{\text{cy_4130N}} := 75 \text{ ksi}$$

Margin of Safety:

$$MS_{\text{tube}} := \left(\frac{F_{\text{cy_4130N}}}{\sigma_{\text{combined}}} \right) - 1$$

$$MS_{\text{tube}} = 0.2$$

MARGIN OF SAFETY IS POSITIVE

DATA FOR THE ULTIMATE LOAD CASE IS NOT AVAILABLE. THE TEST DETAILED IN PARAGRAPH 5.3 VARIFIES THE STRUCTURE OF THE INSTALLATION AT THE ULTIMATE LOAD CASE.

5.3 Structural Test

A structural test was conducted to simulate a limit and ultimate load onto Rappel Mount Provision. This test was conducted to support the structural analysis findings of this document.

The test set-up applied loads at 12 degrees off-vertical and used the same aircraft roof fitting hardware to mount the tube assembly (see Figure 5.3.1 and Figure 5.3.2)

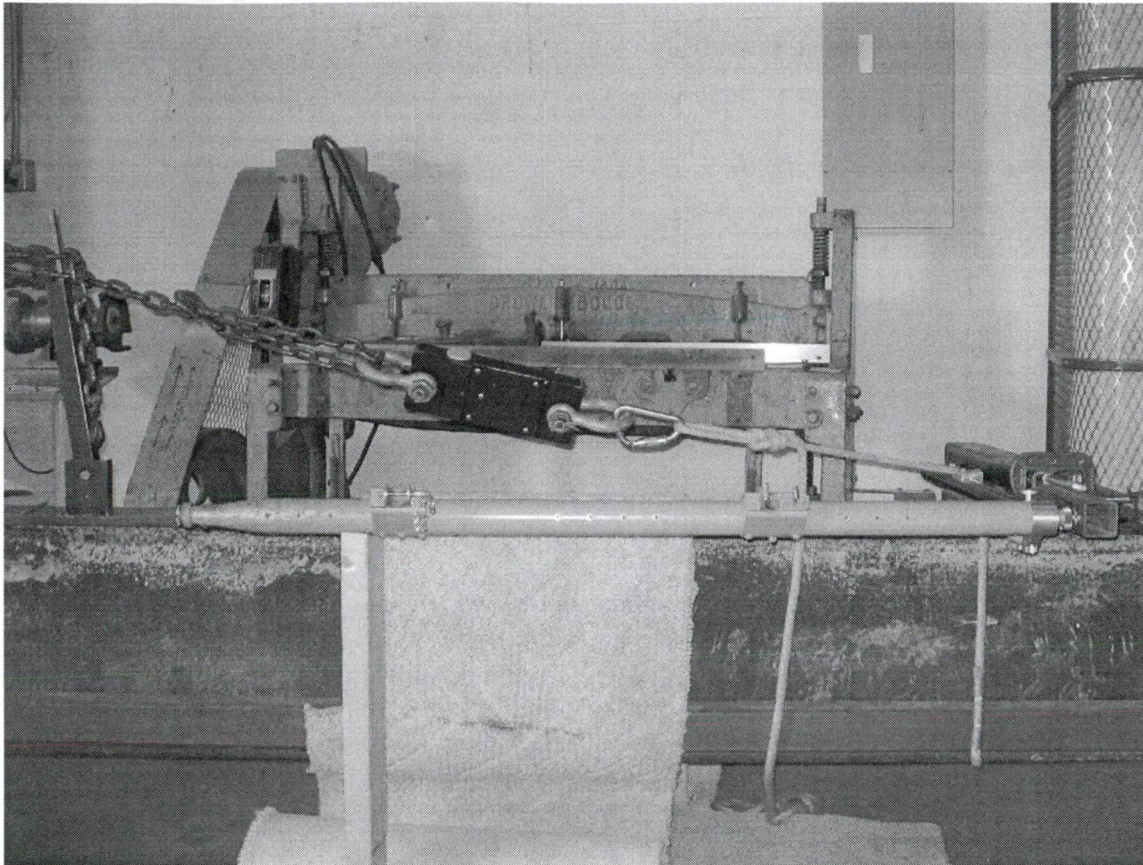


Figure 5.3.1

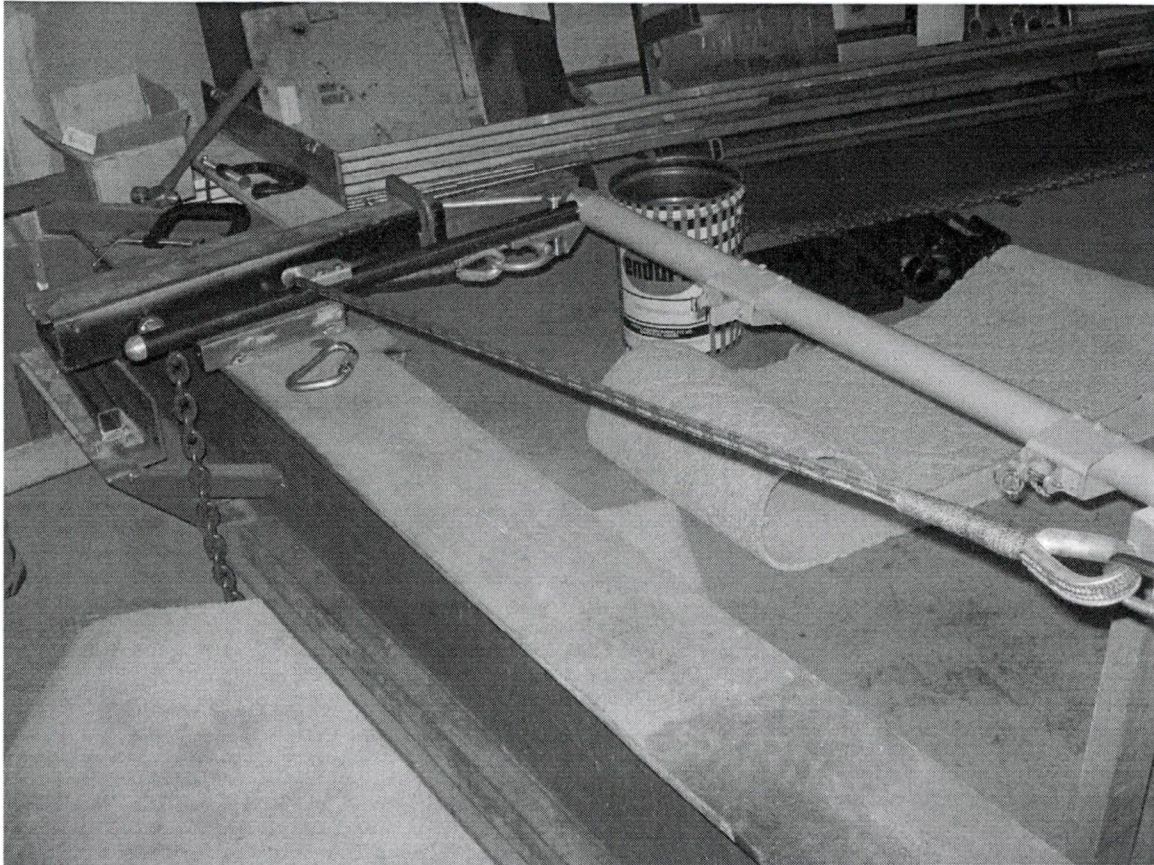


Figure 5.3.2

The test loaded the tube assembly to above limit load (See Figure 5.3.3):

Limit load (resolved load at 12deg) = 1253lbf
Test Limit Load = 1280lbf

The tube assembly showed no signs of permanent deformation.

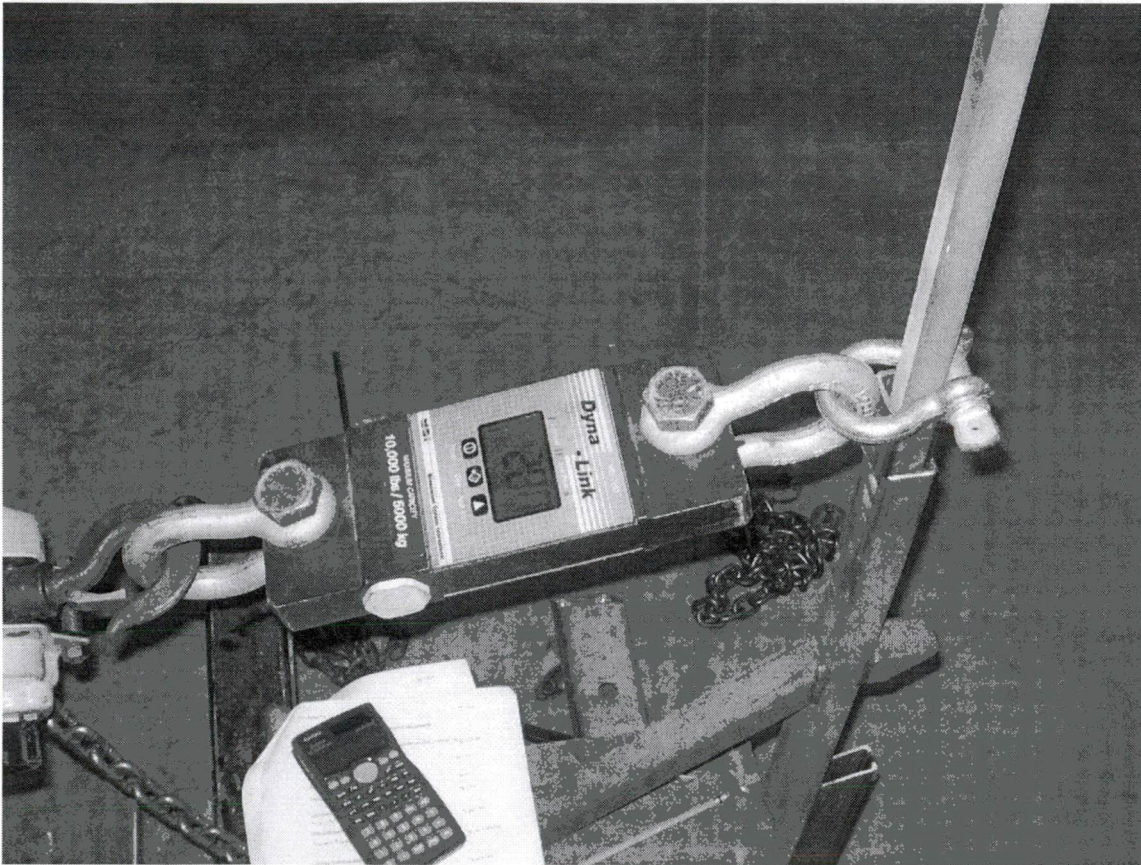


Figure 5.3.3

The test loaded the tube assembly to above ultimate load (See Figure 5.3.4):

Ultimate load (resolved load at 12 deg) = 1880lbf

Test Ultimate Load = 1890lbf

The tube assembly showed no signs of permanent deformation.

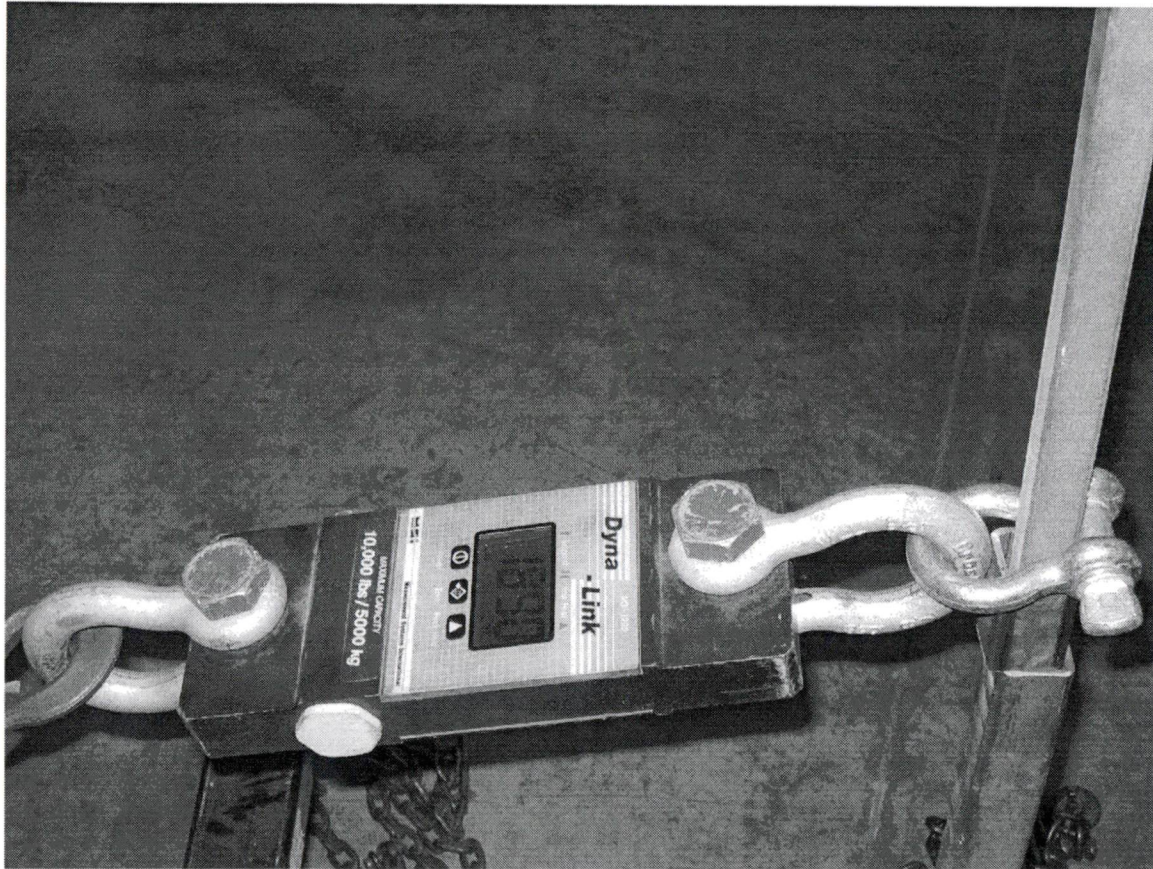


Figure 5.3.4

Results: This test supports the engineering finding in this report.

6.0 STRUCTURAL ANALYSIS – CARGO DEPLOYMENT ARM

6.1 Loads and Factors

Weight of Cargo: Maximum weight of Cargo per FMS Limitation $W_{car} := 250 \text{ lbf}$

External Load Factor: Per AERO Design Ltd. $n_{AD} := 3.0$
Note: this load factor exceeds FAR
29.865 of 2.5

Safety Factor: Per 29.303 $n_{sf} := 1.5$

Fitting Factor: Per 29.625 $n_{ff} := 1.15$

Limit Downward Load Factor:

$$n_{v_lim} := n_{AD} \cdot n_{ff} \quad n_{v_lim} = 3.45$$

Limit Downward Load of Suspended Cargo:

$$P_{car_lim} := W_{car} \cdot n_{v_lim} \quad P_{car_lim} = 862.5 \text{ lbf}$$

Ultimate Downward Load Factor:

$$n_{v_ult} := n_{AD} \cdot n_{sf} \cdot n_{ff} \quad n_{v_ult} = 5.17$$

Ultimate Downward Load of Suspended Cargo:

$$P_{car_ult} := W_{car} \cdot n_{v_ult} \quad P_{car_ult} = 1293.8 \text{ lbf}$$

6.2 Reactions

Lug Strength Analysis Under Transverse Loading (See Figure 6.2.1)

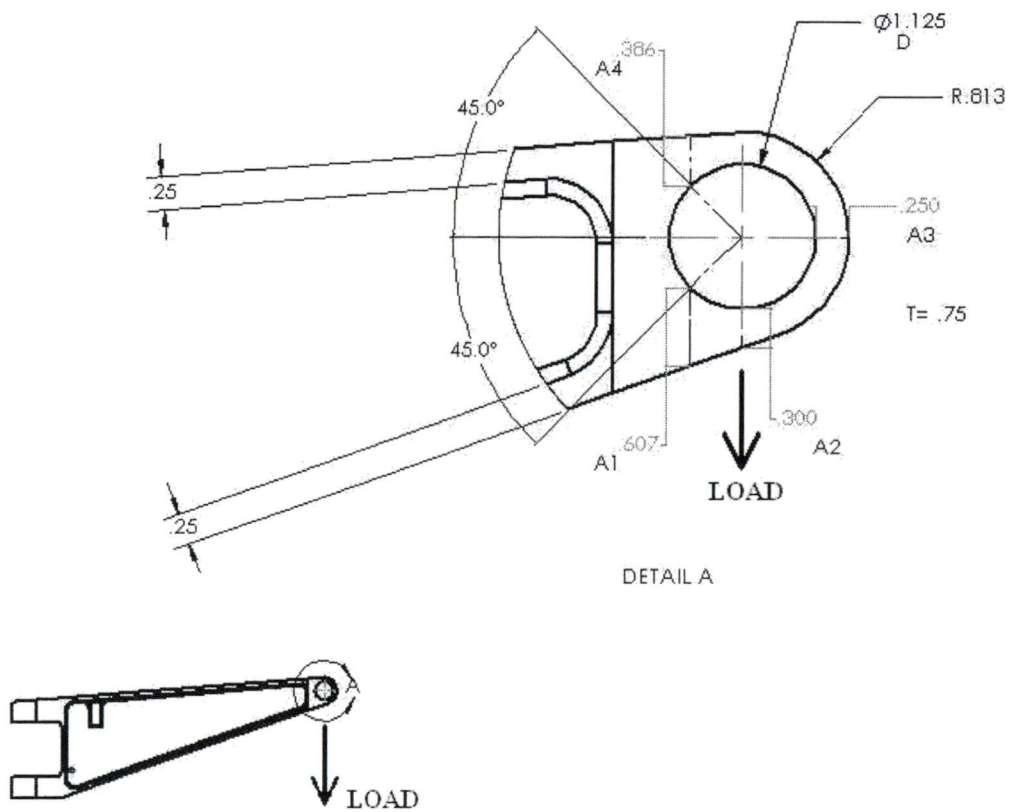


Figure 6.2.1

From Figure 6.2.1

$$t := 0.75 \cdot \text{in}$$

$$D := 1.125 \cdot \text{in}$$

$$A1 := t \cdot 0.607 \cdot \text{in}$$

$$A1 = 0.455 \text{ in}^2$$

$$A2 := t \cdot 0.300 \cdot \text{in}$$

$$A2 = 0.225 \text{ in}^2$$

$$A3 := t \cdot 0.250 \cdot \text{in}$$

$$A3 = 0.187 \text{ in}^2$$

$$A4 := t \cdot 0.386 \cdot \text{in}$$

$$A4 = 0.289 \text{ in}^2$$

$$A_{av} := \frac{6}{\frac{3}{A1} + \frac{1}{A2} + \frac{1}{A3} + \frac{1}{A4}}$$

$$A_{av} = 0.303 \text{ in}^2$$

$$A_{br} := D \cdot t$$

$$A_{br} = 0.844 \text{ in}^2$$

See Bruhn, Figure D1.15:

$$\frac{A_{av}}{A_{br}} = 0.359$$

Use Curve 10, Therefore

$$K_{tu} := 0.343$$

Matl Properties of 6061-T6

$$F_{tu_6061} := 42 \cdot \text{ksi}$$

From Bruhn, D1.12:
Load Capacity of the lug

$$P_{tu} := K_{tu} \cdot A_{br} \cdot F_{tu_6061}$$

$$P_{tu} = 121551 \text{ bf}$$

Margin of Safety:

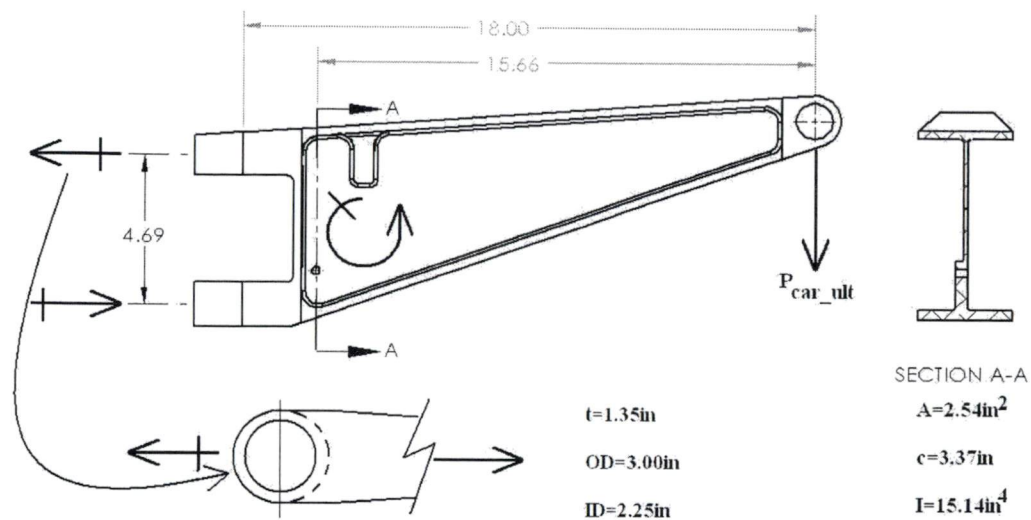
$$MS := \frac{P_{tu}}{P_{car_ult}} - 1$$

$$MS = 8.395$$

MARGIN OF SAFETY IS POSITIVE

Bending of the Cargo Arm (see Figure 6.2.2)

Note: Bending analysis at location where the M/I ratio is the greatest.



Moment of Inertia

$$I_{\text{arm}} := 15.14 \cdot \text{in}^4$$

Centroid

$$c_{\text{arm}} := 3.37 \cdot \text{in}$$

$$M_{\text{arm}} := 15.66 \cdot \text{in} \cdot P_{\text{car_ult}}$$

Bending Moment

$$M_{\text{arm}} = 20260.1 \text{ in}\cdot\text{lbf}$$

Stress

$$\sigma_{\text{arm}} := \frac{M_{\text{arm}} \cdot c_{\text{arm}}}{I_{\text{arm}}}$$

$$\sigma_{\text{arm}} = 4.5 \text{ ksi}$$

Margin of Safety:

$$MS := \frac{F_{\text{tu_6061}}}{\sigma_{\text{arm}}} - 1$$

$$MS = 8.3$$

MARGIN OF SAFETY IS POSITIVE

Reactions at Stanchion Lugs:

$$R_{\text{top_lug}} := \frac{P_{\text{car_ult}} \cdot 18 \cdot \text{in}}{4.69 \cdot \text{in}}$$

$$R_{\text{top_lug}} = 4965.41 \text{bf}$$

Analysis of the Cargo Arm Top Stanchion Lug:

$$\text{ID} := 2.25 \cdot \text{in}$$

$$\text{OD} := 3.0 \cdot \text{in}$$

$$t_{\text{lug}} := 1.35 \cdot \text{in}$$

$$A_{\text{cs_lug}} := (\text{OD} - \text{ID}) \cdot t_{\text{lug}} \quad \text{Cross Sectional Area of Lug}$$

$$A_{\text{cs_lug}} = 1.01 \text{in}^2$$

Stress :

$$\sigma_{\text{top_lug}} := \frac{R_{\text{top_lug}}}{A_{\text{cs_lug}}}$$

$$\sigma_{\text{top_lug}} = 4.9 \text{ksi}$$

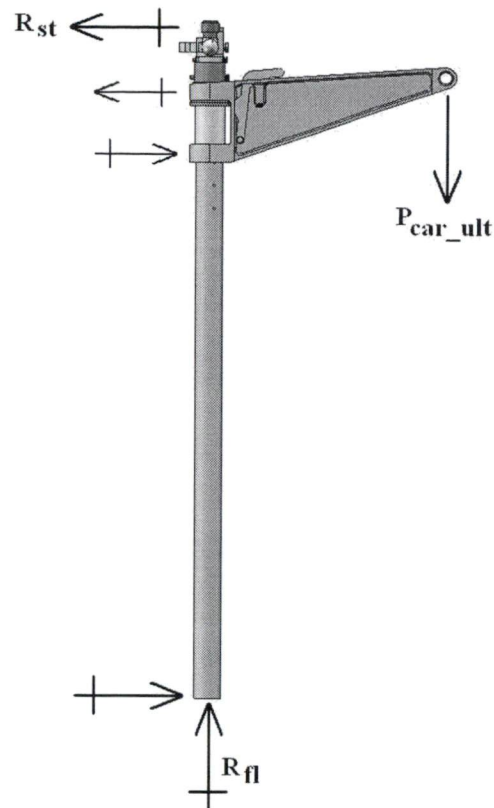
Margin of Safety:

$$\text{MS} := \frac{F_{\text{tu_6061}}}{\sigma_{\text{top_lug}}} - 1$$

$$\text{MS} = 7.6$$

MARGIN OF SAFETY IS POSITIVE

The vertical load on the Cargo Arm places a compression and a bending moment on the stanchion.



GEOMETRY:

Refer to AERO Design drawings 79201 for further information.

Beam Structure of Arm: Length of Cargo Arm from the root to the lug at the tip. $L_{arm} := 18.00 \cdot \text{in}$

Height of arm $h_{arm} := 6.75 \cdot \text{in}$

Stanchion: Diameter of stanchion. $D_{stn} := 2.00 \cdot \text{in}$

Thickness of stanchion tube wall. $t_{stn} := 0.12 \cdot \text{in}$

$d_{stn} := D_{stn} - 2 \cdot t_{stn}$ Inside Diameter of stanchion. $d_{stn} = 1.76 \cdot \text{in}$

Total length of stanchion tube from floor to ceiling. $L_{st} := 50.7 \cdot \text{in}$

$a := \left(46.6 \cdot \text{in} - \frac{h_{arm}}{2} \right)$ Distance from center of lugs down to floor. $a = 43.23 \cdot \text{in}$

LOADS:

$$P_x := W_{\text{cargo}} \cdot n_x \cdot n_{st} \cdot n_{ff}$$

Ultimate Vertical Load applied to lug at end of Cargo arm. $P_x = 1294 \text{ lbf}$

$$M_{\text{arm}} := P_x \cdot L_{\text{arm}}$$

Bending Moment at root of Cargo arm due to vertical load. $M_{\text{arm}} = 23287 \text{ lbf} \cdot \text{in}$

Ultimate Vertical Load applied to lug at end of Cargo Arm. $P_{\text{car_ult}} = 1294 \text{ lbf}$

Distance between Cargo Arm lug and center of stanchion. $L_{\text{arm}} = 18.00 \text{ in}$

$$M_{\text{st}} := P_{\text{car_ult}} \cdot L_{\text{arm}}$$

Bending Moment applied to stanchion by vertical load. $M_{\text{st}} = 23287 \text{ lbf} \cdot \text{in}$

Total length of stanchion tube from floor to ceiling. $L_{\text{st}} = 50.70 \text{ in}$

Distance from center of sleeve down to the floor. $a = 43.23 \text{ in}$

$$b := L_{\text{st}} - a$$

Distance from center of sleeve up to the ceiling. $b = 7.47 \text{ in}$

Outside Diameter of the stanchion. $D_{\text{stn}} = 2.00 \text{ in}$

Inside Diameter of the stanchion. $d_{\text{stn}} = 1.76 \text{ in}$

$$I_{\text{st}} := \frac{\pi}{64} \cdot (D_{\text{stn}}^4 - d_{\text{stn}}^4)$$

Moment of Inertia of the stanchion tube.

$$I_{\text{st}} = 0.31 \text{ in}^4$$

$$M_{\text{no_comp}} := \frac{a}{L_{\text{st}}} \cdot M_{\text{st}}$$

Maximum Bending Moment in the stanchion if the compression component of the applied load were to be ignored.

$$M_{\text{no_comp}} = 19854 \text{ lbf} \cdot \text{in}$$

Bruhn, Equation A5.9 breaks down the bending moment equations into terms that are looked up on Table A5.1, Case VIII. Bending moments on each side of the applied couple are defined differently.

$$j := \sqrt{\frac{E_{2024} \cdot I_{st}}{P_{car_ult}}}$$

Axial Load Factor (Ref. Bruhn, Page A5.21). $j = 51 \text{ in}$

$$C_{1a} := (-1) \cdot M_{st} \cdot \frac{\cos\left(\frac{b}{j}\right)}{\sin\left(\frac{L_{st}}{j}\right)}$$

First term of Eq. A5.9, where $x < a$.

$$C_{1a} = -27480 \text{ lbf} \cdot \text{in}$$

Second term of Eq. A5.9, where $x < a$.

$$C_{2a} := 0 \text{ lbf} \cdot \text{in}$$

$$M_a(x) := C_{1a} \cdot \sin\left(\frac{x}{j}\right) + C_{2a} \cdot \cos\left(\frac{x}{j}\right)$$

Equation A5.9 with terms C1 and C2 substituted. The term $f(w)$ is ignored because no uniform load is applied.

Bending Moment in stanchion solved just below attachment of Cargo Arm.

$$M_a(a) = -20603 \text{ lbf} \cdot \text{in}$$

$$C_{1b} := (-1) \cdot M_{st} \cdot \frac{\cos\left(\frac{a}{j}\right)}{\tan\left(\frac{L_{st}}{j}\right)}$$

First term of Eq. A5.9, where $x > a$.

$$C_{1b} = -10020 \text{ lbf} \cdot \text{in}$$

$$C_{2b} := M_{st} \cdot \cos\left(\frac{a}{j}\right)$$

Second term of Eq. A5.9, where $x > a$.

$$C_{2b} = 15410 \text{ lbf} \cdot \text{in}$$

$$M_b(x) := C_{1b} \cdot \sin\left(\frac{x}{j}\right) + C_{2b} \cdot \cos\left(\frac{x}{j}\right)$$

Equation A5.9 with terms C1 and C2 substituted. The term $f(w)$ is ignored because no uniform load is applied.

Bending Moment in stanchion solved just above attachment of Cargo Arm.

$$M_b(a) = 2685 \text{ lbf} \cdot \text{in}$$

$$M_{\max} := |M_a(a)|$$

Maximum Bending Stress occurs at "a", where Cargo Arm attaches to stanchion.

$$M_{\max} = 20603 \text{ lbf} \cdot \text{in}$$

$$f_{b_st} := \frac{M_{\max} \left(\frac{D_{stn}}{2} \right)}{I_{st}}$$

Bending Stress in stanchion due to Cargo Arm Loads.

$$f_{b_st} = 65.5 \text{ ksi}$$

Ultimate Tensile Strength of 2024-T3 tube (Mil-Hdbk-5H).

$$F_{tu_2024} = 64 \text{ ksi}$$

D/t ratio for stanchion tube.

$$\frac{D_{stn}}{t_{stn}} = 17$$

Ultimate Bending Modulus of 2024-T3 stanchion tube (Ref. Mil-Hdbk-5H, Figure 3.11.1.1.1).

$$F_b := 66.6 \text{ ksi}$$

$$MS := \frac{F_b}{f_{b_st}} - 1$$

Ultimate Bending Margin of Safety of stanchion.

$$MS = 0.02$$

Bending moment applied by cargo arm to stanchion is reacted at the floor and ceiling attachments.

$$R_{st} := \frac{M_{st}}{L_{st}}$$

Lateral Reaction Loads at top and bottom of stanchion are equal.

$$R_{st} = 459 \text{ lbf}$$

Lateral and Longitudinal load allowable for ceiling hard-point (Ref. Bell Helicopter Report 205-099-205).

$$P_{lat} := 1250 \text{ lbf}$$

$$MS := \frac{P_{lat}}{R_{st}} - 1$$

Margin of Safety of stanchion attachment to ceiling hard-point for lateral reaction loads.

$$MS = 1.72$$

Vertical load applied by cargo arm to stanchion is reacted at the floor attachment hardpoint.

$$R_{fl} := P_{car_vh}$$

Vertical Reaction Load at bottom of stanchion.

$$R_{fl} = 1294 \text{ lbf}$$

Vertical load allowable for floor hard-point (Ref. Bell Helicopter Report 205-099-205).

$$P_{ver} := 2150 \text{ lbf}$$

$$MS := \frac{P_{ver}}{R_{fl}} - 1$$

Margin of Safety of stanchion attachment to floor hard-point for vertical load.

$$MS = 0.66$$

MARGIN OF SAFETY IS POSITIVE

6.3 Structural Test

A structural test was conducted to simulate a limit and ultimate load onto the Cargo Deployment Arm and Stanchion Tube. This test was conducted to support the structural analysis findings of this document.

The test set-up applied loads at vertical and used the same aircraft roof fitting hardware to mount the tube assembly (see Figure 6.3.1 and Figure 6.3.2).

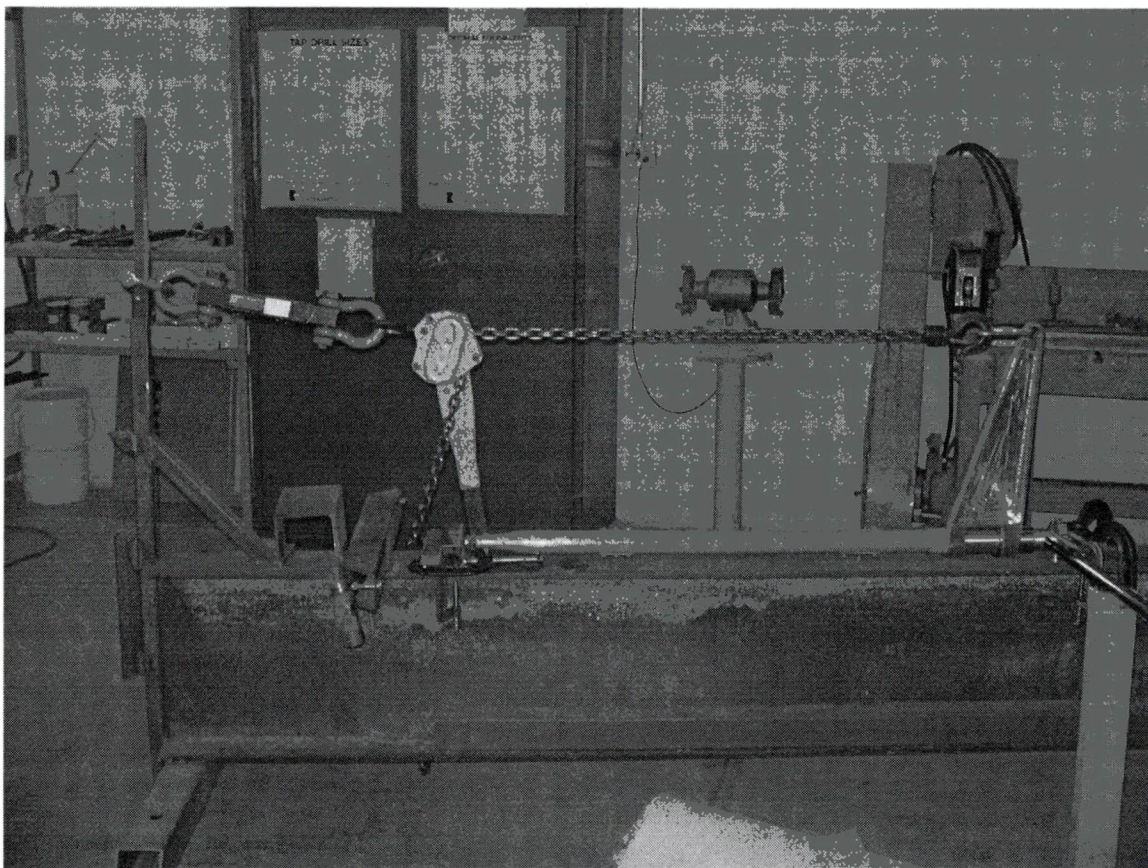


Figure 6.3.1

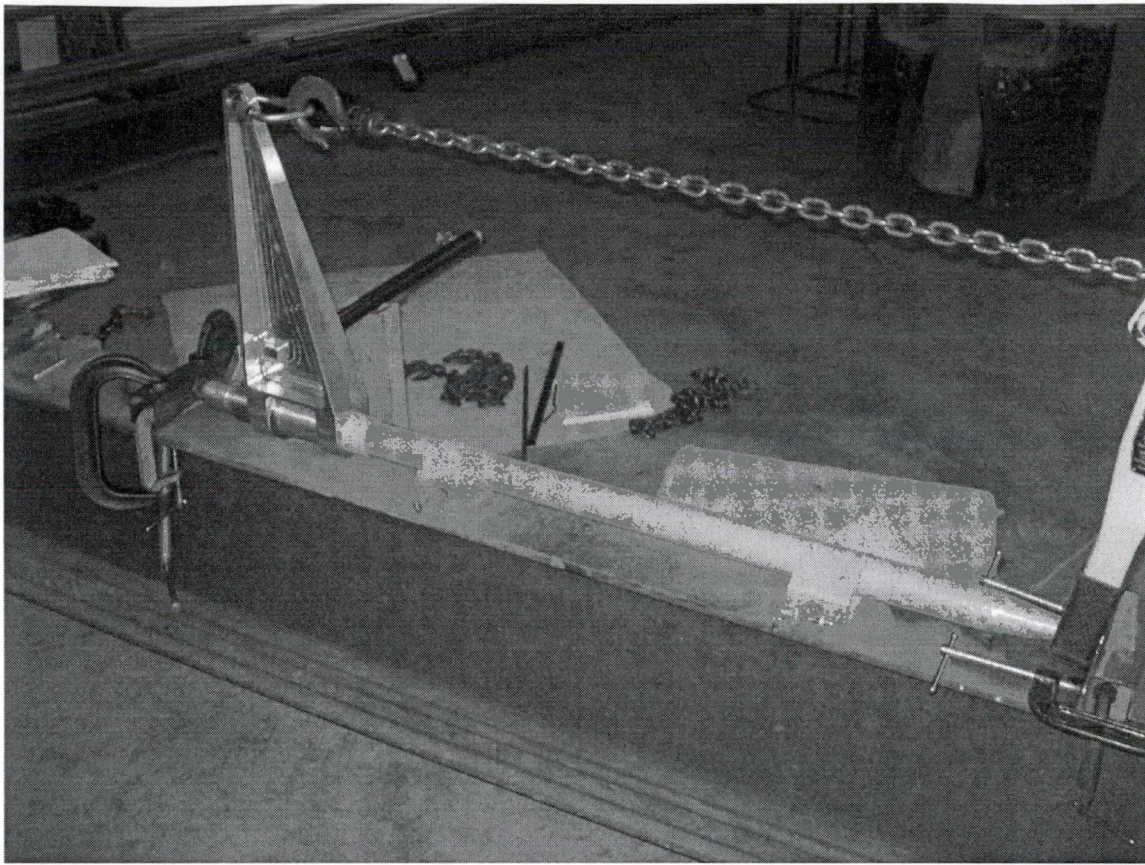


Figure 6.3.2

The test loaded the tube assembly to above limit load (See Figure 6.3.3):

Limit load (250lbf x 3) = 750 lbf

Test Limit Load = 790 lbf

The assembly showed no signs of permanent deformation.

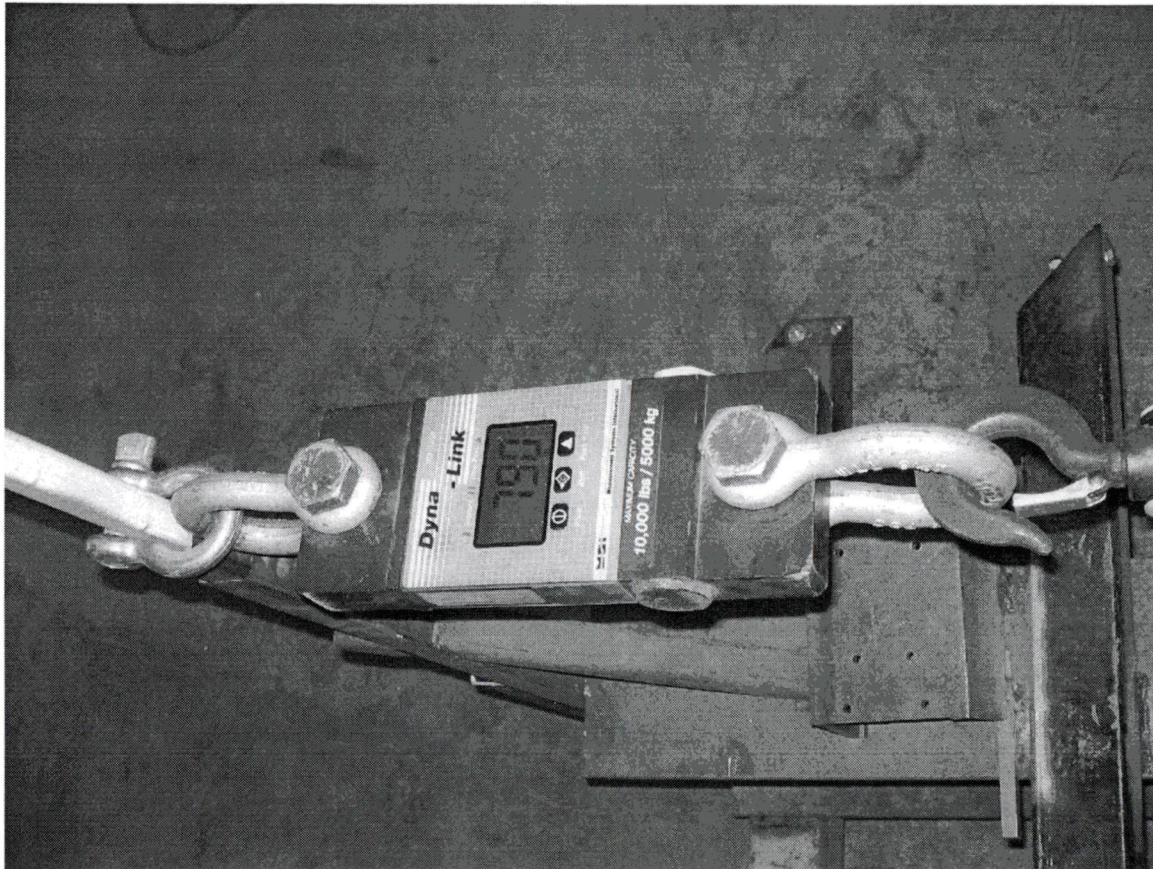


Figure 6.3.3

The test loaded the tube assembly to above ultimate load (See Figure 6.3.4):

Ultimate load $(250\text{ lbf} \times 3 \times 1.5) = 1125\text{ lbf}$

Test Ultimate Load = 1140 lbf

The tube assembly showed no signs of permanent deformation.

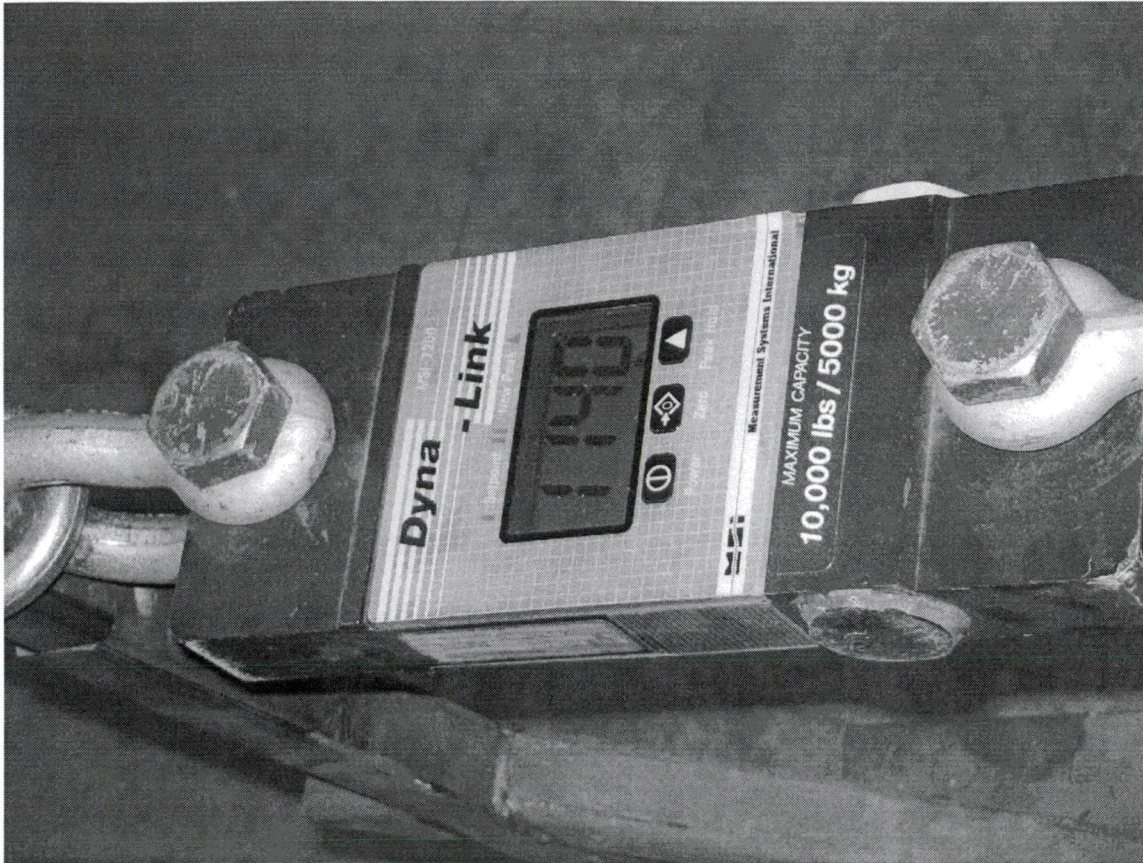


Figure 6.3.4

Results: This test supports the engineering finding in this report.

7.0 STRUCTURAL ANALYSIS – RAPPEL STEP

7.1 Loads and Factors

There are two categories of load that can be applied to this step:

- 1) Aerodynamic Loads
- 2) Personnel Loads

There are no loads for this step specified by airworthiness regulations.

Aerodynamic Drag Load:

The forward mounting plate at stn 84.46 is the critical component for this analysis. This plate has the greatest frontal area and greatest distance between supports.

Drag Coefficient (plate) per Hoerner

$$C_d := 1.95$$

Air Density

$$\rho := 0.002376898 \cdot \frac{\text{slug}}{\text{ft}^3}$$

Aircraft "Never Exceed" Velocity

$$v_{ne} := 219.4 \cdot \frac{\text{ft}}{\text{sec}}$$

Aircraft "Design" Velocity

$$v_d := \frac{v_{ne}}{0.9}$$

Frontal Area of Mounting Plate 79821-01

$$A_{\text{plate_stn84}} := 65.4 \cdot \text{in}^2$$

Force Applied to Mounting Plate 79821-01 as a result of aerodynamic drag at V_d .

$$F_d := 0.5 \cdot \rho \cdot v_d^2 \cdot A_{\text{plate_stn84}} \cdot C_d$$

$$F_d = 62.5 \text{ lbf}$$

This force is then applied to the mounting plate for beam bending analysis

Reaction At "A"

$$R_A := \frac{F_d \cdot 7.6 \cdot \text{in}}{20.77 \cdot \text{in}} \quad R_A = 22.9 \text{ lbf}$$

Reaction At "C"

$$R_C := \frac{F_d \cdot 13.17 \cdot \text{in}}{20.77 \cdot \text{in}} \quad R_C = 39.7 \text{ lbf}$$

Max Bend Moment at "B"

$$M_B := R_A \cdot 13.17 \cdot \text{in} \quad M_B = 301.4 \text{ in} \cdot \text{lbf}$$

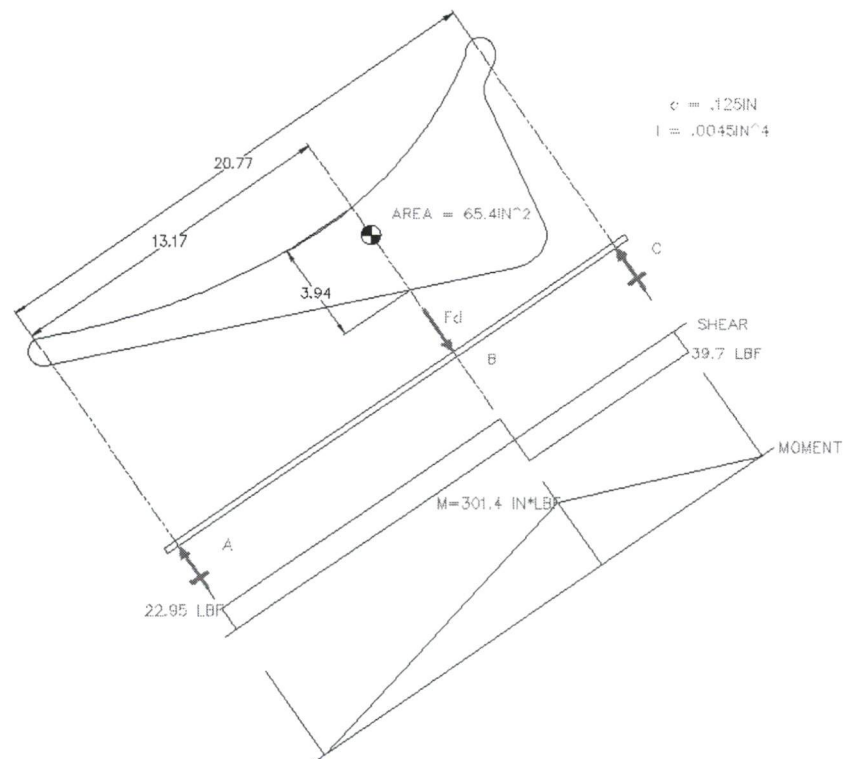


Figure 7.1.1

Section Properties at "B":

Centroid

$$c_B := 0.125 \cdot \text{in}$$

Moment of Inertia

$$I_B := 0.0045 \cdot \text{in}^4$$

Stress:

$$\sigma_{MB} := \frac{M_B \cdot c_B}{I_B}$$

$$\sigma_{MB} = 8373 \text{ psi}$$

Mechanical Properties 6061-T

$$F_{tu_6061} := 30 \cdot \text{ksi}$$

Margin of Safety:

$$MS_{MB} := \frac{F_{tu_6061}}{\sigma_{MB}} - 1$$

$$MS_{MB} = 2.6$$

MARGIN OF SAFETY IS POSITIVE

Operational Loads

The Rappel Step is used in flight as a stabilizing structure for which suspended rappellers exiting the helicopter can steady and prepare themselves for the rappel. This operational mode is not likely to induce much load onto the Rappel Step since the rappeller is primarily supported by the rappel rope.

A more critical operational load case for the rappel step would be persons using the Rappel Step for entering or exiting the helicopter while on the ground. The following analysis shall determine that the step can support two (2) 95th percentile males, standing shoulder to shoulder, at 2Gs. The analysis will assume the load is normal to the stepping surface of the step.

The 2G load factor conservatively accounts for dynamic forces the persons induces by exiting or entering the helicopter.

Anthropometric Data - 95th Percentile Male

Weight

$$W_{95_M} := 216.3 \text{ lbf}$$

Shoulder Breadth (Ground Forces)

$$D_{sh_95_M} := 19.6 \text{ in}$$

Load factor for analysis

$$n_{lf_step} := 2$$

Load per Person on step

$$P_{step} := W_{95_M} \cdot n_{lf_step}$$

$$P_{step} = 432.61 \text{ lbf}$$

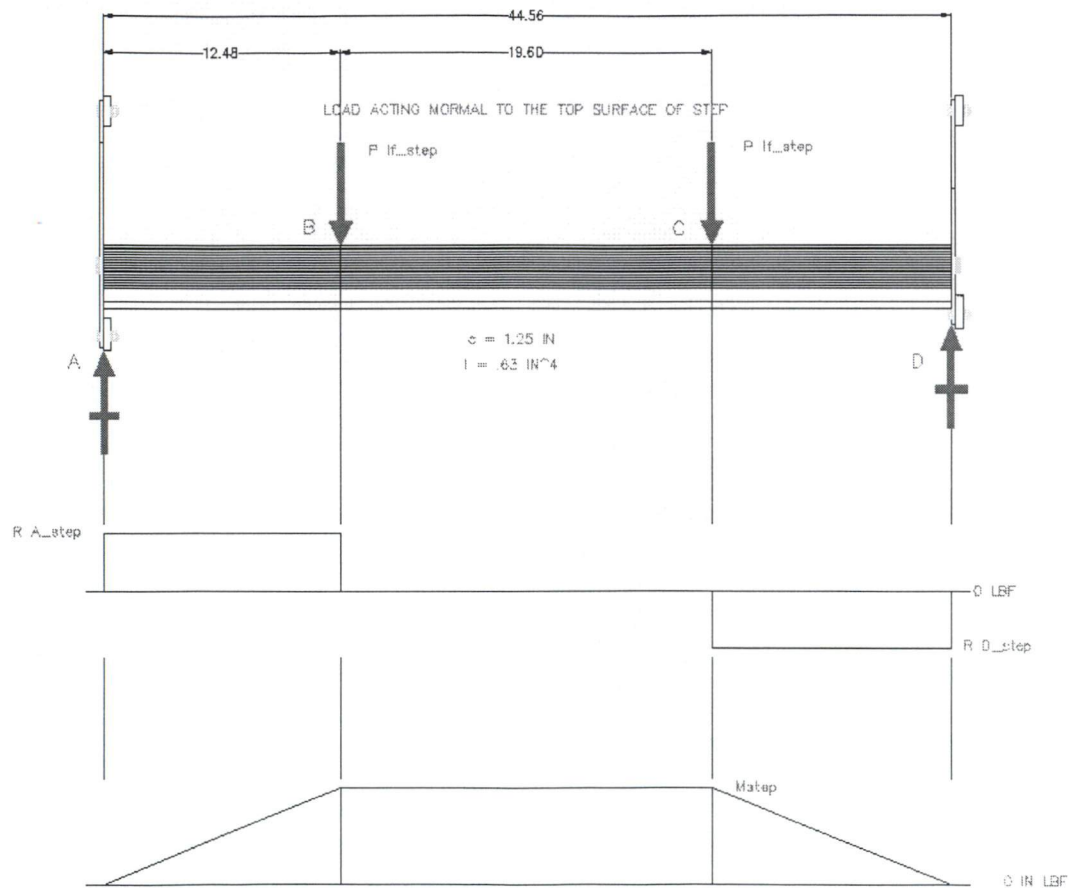


Figure 7.1.2

Reactions

$$R_{D_step} := \frac{P_{step} \cdot 12.48 \cdot \text{in} + P_{step} \cdot (D_{sh_95_M} + 12.48 \cdot \text{in})}{44.56 \cdot \text{in}}$$

$$R_{D_step} = 432.6 \text{ lbf}$$

$$R_{A_step} := \frac{P_{step} \cdot 12.48 \cdot \text{in} + P_{step} \cdot (D_{sh_95_M} + 12.48 \cdot \text{in})}{44.56 \cdot \text{in}}$$

$$R_{A_step} = 432.6 \text{ lbf}$$

Bending Moment

$$M_{B_step} := R_{A_step} \cdot 12.48 \cdot \text{in}$$

$$M_{B_step} = 5398.8 \text{ in} \cdot \text{lbf}$$

Mechanical Properties of the Step Extrusion

Centroid

$$c_{step} := 1.25 \cdot \text{in}$$

Moment of Inertia

$$I_{step} := 0.63 \cdot \text{in}^4$$

Stress

$$\sigma_{step} := \frac{M_{B_step} \cdot c_{step}}{I_{step}}$$

$$\sigma_{step} = 10712 \text{ psi}$$

Margin of Safety:

$$MS_{step} := \frac{F_{tu_6061}}{\sigma_{step}} - 1$$

$$MS_{step} = 1.8$$

MARGIN OF SAFETY IS POSITIVE

Shear Load on the AN4 bolts holding the step onto the plate is the same on both sides of the step. This analysis is also applied to the AN4 bolts attaching the plates to the helicopter hardpoints.

Mechanical Properties of AN4 Bolt (single shear)

$$F_{su_AN4} := 3680 \cdot \text{lbf}$$

Margin of Safety:

$$MS_{step_AN4} := \frac{F_{su_AN4} \cdot 2}{R_{A_step}} - 1$$

$$MS_{step_AN4} = 16$$

MARGIN OF SAFETY IS POSITIVE

7.2 Rappel Step Compliance with FAR 29.251, Vibration

The Rappel Step Installation has been found to be in compliance with FAR 29.251. Refer to AERO Design Ltd. Flight Test Plan/Report TP757.02 for details.

8.0 COMPLIANCE WITH 29.785(A), SEATS, BIRTHS, LITTERS, SAFETY BELTS, AND HARNESES.

The installation of the Rappel Mount Provision and Cargo Deployment Arm has been evaluated for proximity to the helicopter occupant extremity strike envelope. This section evaluated the extremity strike envelope of the outboard-most occupants on the forward facing, five-position seat assembly (See Figure 8.0.1).

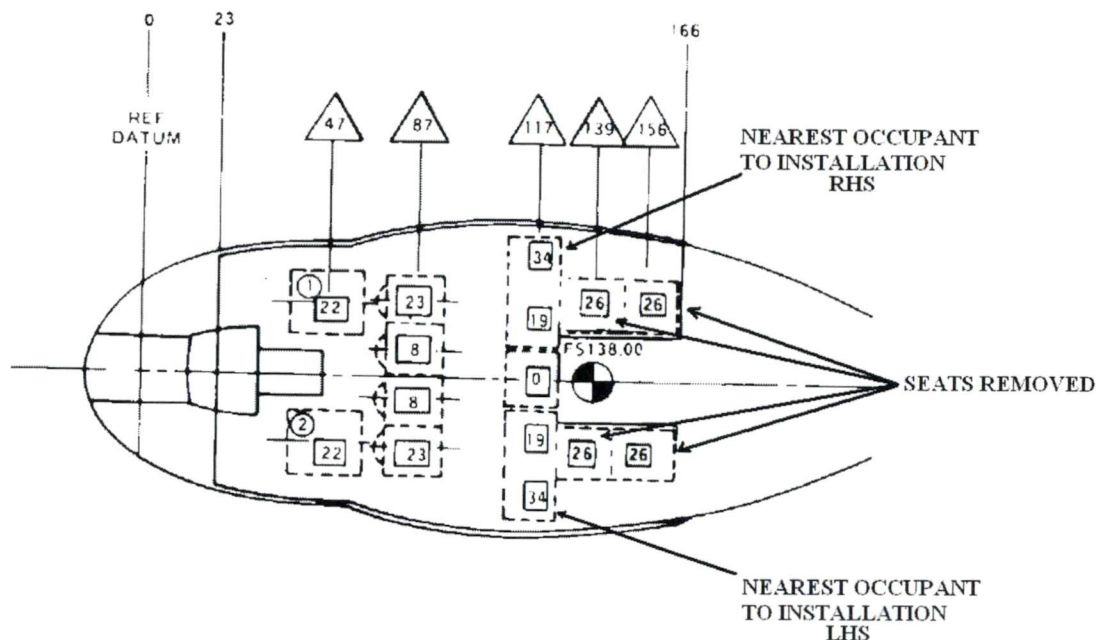


Figure 8.0.1

AC29-2C Para (AC29.785)(2)(ii) states:

(2) The following criteria have been found satisfactory for preventing occupant head injuries:

(ii) Elimination of injurious objects within striking distance of the head and other vital parts can be accomplished by removal of objects with sharp edges or rigid surfaces from within striking distance of vital parts of the occupant. Dimensions and weights for typical occupants are available in U.S. Army USAULABS Reports 70-22 (August 1969) and 66-39 (June 1966) and NACA Report TN 2991 (August 1953). Because of the range of occupant head striking distance, a combination of "elimination of injurious objects" and "cushioned rests" may be required for some interior configurations.

The position of this document is that the installation of the Rappel Mount Provision and Cargo Deployment Arm do not add injurious objects within the strike envelope of the nearest occupant to the installation.

Figures 8.0.2 and 8.0.3 show a ninety-fifth percentile male occupant's extremity strike envelopes restrained with the lap belt only. These strike envelopes are based on U.S. Army USAAVLABS TR 70-22.

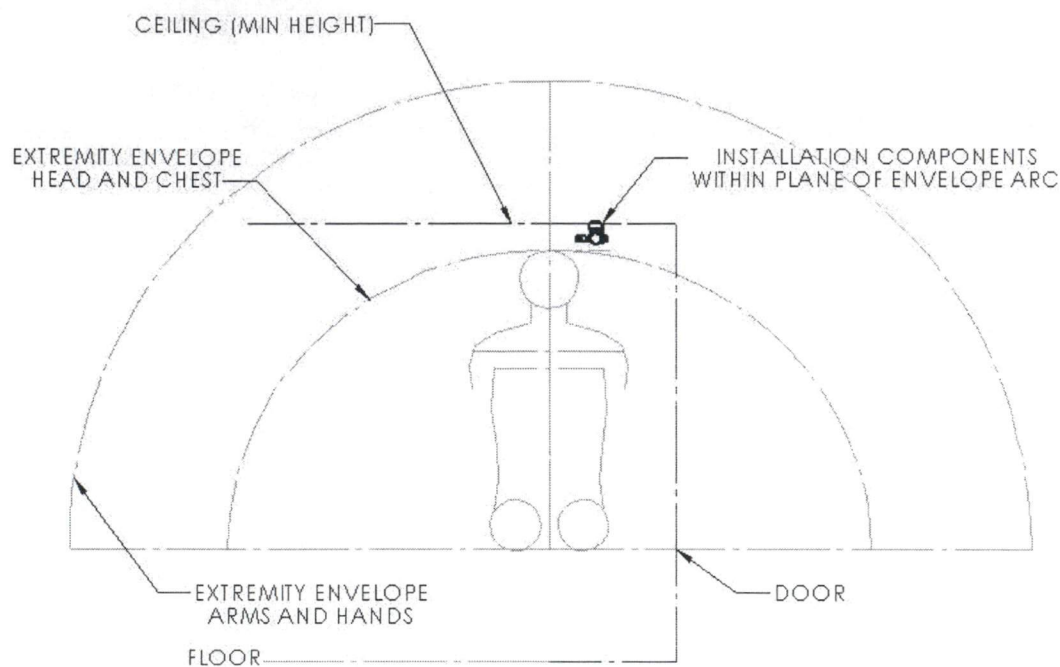
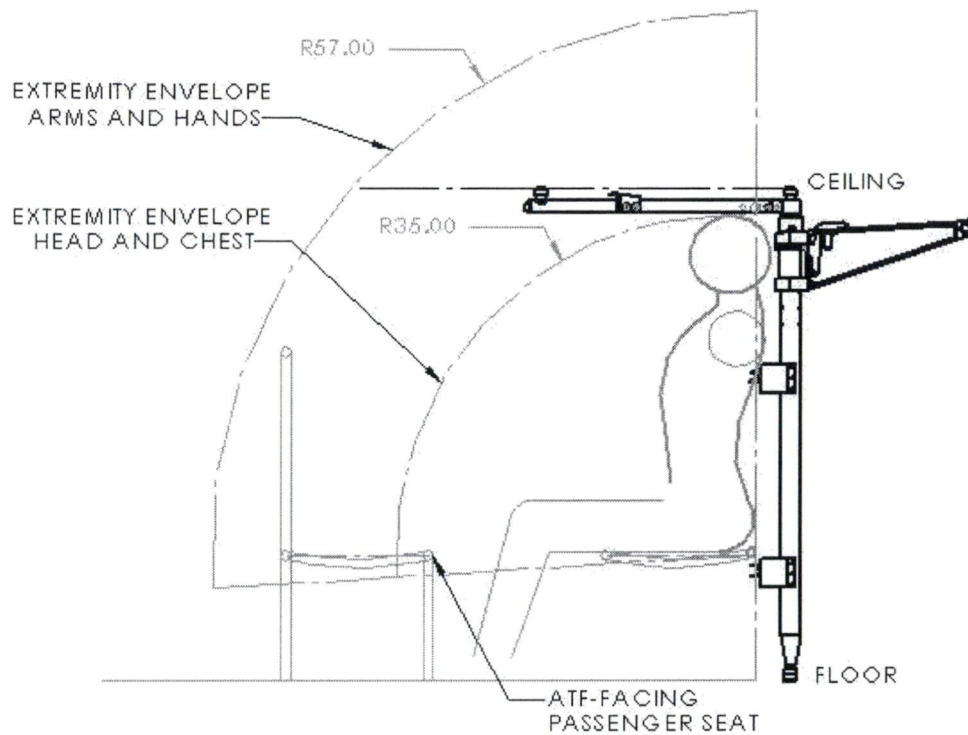


Figure 8.0.2

**Figure 8.0.3**

8.1 Primary Hazards:

The components of the Rappel Mount Provision and Cargo Deployment Arm Installation are outside of the seated and restrained occupant's head and chest strike envelope.

8.2 Secondary Hazards:

Compromising the occupant's ability to effect a rapid escape from the aircraft due to trapping or injuring the lower extremities by this installation has been considered. The lower extremities of the occupant are not in the proximity of this installation and therefore unlikely to be injured or trapped by this installation.

8.3 Tertiary Hazards:

This installation is within the upper limb strike envelope of the nearest occupant. The rounded features of all of the installation's components eliminate the likelihood of a piercing injury. The occupant may sustain a blunt force upper limb injury by striking the installation in the occurrence of an emergency landing.

This injury occurrence potential is similar to the injury occurrence potential of the same occupant striking the aft facing passenger seat structure of the type certified design of the aircraft. In the case of a forward emergency landing condition, the aft facing seat structure is within the upper limb strike envelope of the occupant. The injury occurrence potential of the occupant striking the seat assembly and the rappel mount provision is similar in that the struck object is a rounded tube or fitting.

It should be noted that the aft facing seat assembly is also within the occupant's head and chest strike envelope. Furthermore, the off-set seating arrangement between the aft-facing and forward-facing seats exposes the forward facing occupants to the vertical structure members of the aft-facing seats.

By comparison, the installation of the Rappel Mount Provision and Cargo Deployment Arm provide no less tertiary hazards than the type certified design of the aircraft.

8.4 Upper Torso Vulnerability:

The components of the Rappel Mount Provision and Cargo Deployment Arm Installation are behind the left shoulder of the seated and retrained occupant. The strike envelope for upper torso movement has been considered and does not interface this installation.

9.0 COMPLIANCE WITH 29.785(E), SEATS, BIRTHS, LITTERS, SAFETY BELTS, AND HARNESES.

The Rappel Mount Provision and Cargo Deployment Arm Installation position is at the outboard-most edge of the passenger seats and within close proximity to the crew door. Passengers moving about the cabin would not likely be within the proximity of this installation during normal flight.

APPENDIX A – AIRCRAFT AIRWORTHINESS DIRECTIVES

Directives Pertaining to Aircraft Model: BELL TEXTRON - USA, 212

New	Prod Type	Ctry.	AD Number		AD Subject	Service Bulletin or Reference	Repeat Insp.?
	A	CF	<u>CF-98-15</u>	<input type="checkbox"/>	EXTERNAL RESCUE SYSTEMS	CAR 702.21	NO
	A	CF	<u>CF-97-04</u>	<input type="checkbox"/>	FUEL LINE - CHANGE TO STAINLESS ELBOW FITTING	212-96-157	NO
	A	CF	<u>CF-96-06</u>	<input type="checkbox"/>	EMERGENCY ESCAPE PANELS		YES
	A	CF	<u>CF-95-20R1</u>	<input type="checkbox"/>	BOLTS OF FLIGHT CONTROL SERVO ACTUATORS	212-67-01	NO
	A	CF	<u>CF-94-07</u>	<input type="checkbox"/>	ZINC PRIMER AS OVERHEAT INDICATOR	212-93-89 REV A	REFER TO AD
	A	CF	<u>CF-91-29R1</u>	<input type="checkbox"/>	AFT FACING SEAT HEADRESTS		REFER TO AD
	A	CF	<u>CF-91-27</u>	<input type="checkbox"/>	EMERGENCY ESCAPE RELEASE HANDLE COVERS		REFER TO AD
	A	CF	<u>CF-90-16R3</u>	<input type="checkbox"/>	MAIN ROTOR YOKE	212-90-60 REV A	REFER TO AD
	A	CF	<u>CF-88-23R1</u>	<input type="checkbox"/>	BLADE STRAP PINS	A8-27-45	REFER TO AD
	A	EU	<u>2006-0241</u>	<input type="checkbox"/>	Replacement of Main Case P/N BC85-051 and piston BC85-052 with improved units made of stainless steel 6S80D.	CALEDONIAN AIRBORNE SYSTEMS SB CPT-600/900/SB-01	REFER TO AD
	A	US	<u>2007-22-02</u>	<input type="checkbox"/>	Tail rotor blade (blade) forward tip weight retention block (tip block) and the aft tip closure (tip closure)	212-00-111	REFER TO AD
	A	US	<u>2007-19-53</u>	<input type="checkbox"/>	Missing Adhesive to the tip weight screws.	ASB 212-07-125	NO
	A	US	<u>2005-20-38</u>	<input type="checkbox"/>	To prevent rupture of an adapter, uncontrolled jetting of pressurized gas from the nitrogen bottle	AA-05005, REVISION A	REFER TO AD
	A	US	<u>2003-01-04</u>	<input type="checkbox"/>	204B, 205A /A-1/B, 212 - INSPECT MAIN ROTOR HUB	ASB 212-94-92 REV A	REFER TO AD
	A	US	<u>2002-22-14</u>	<input type="checkbox"/>	204B, 205A/B, 212, 214B/B1 - MAIN ROTOR TT STRAPS		REFER TO AD

	A	US	<u>2002-19-05</u>	□	212 MODELS - VERTICAL FIN FORWARD SPAR CAP	ASB 212-00-110 REV A	REFER TO AD
	A	US	<u>2001-13-01</u>	□	TAIL ROTOR COUNTERWEIGHT BELLCRANK RETENTION NUT	ASB 212-00-107RA	REFER TO AD
	A	US	<u>2001-08-04</u>	□	MAIN ROTOR ACTUATOR LOCKING WASHER	ASB 41105950-67A-01	REFER TO AD
	A	US	<u>2000-15-52</u>	□	MAIN ROTOR MAST/TRUNNION		REFER TO AD
	A	US	<u>98-11-15</u>	□	TAIL ROTOR YOKE ASSY FAILURE.	ASB 212-96-100/101	REFER TO AD
	A	US	<u>94-18-09</u>	□	MAIN TRANSMISSION LOWER PLANETARY SPIDER	212-93-83	REFER TO AD
	A	US	<u>93-17-12</u>	□	MAIN ROTOR TRANSMISSION LOWER PLANETARY SPIDER	SUPERCEDES 92-11-07	REFER TO AD
	A	US	<u>93-05-01</u>	□	POSSIBLE MAIN ROTOR YOKE FATIGUE FAILURE		REFER TO AD
	A	US	<u>92-23-01</u>	□	PREVENT SEPERATION MAIN ROTOR PILLOW BLOCKS	212-90-62 REV A	REFER TO AD
	A	US	<u>92-13-10</u>	□	TAIL ROTOR DRIVESHAFT HANGER BEARINGS	SUPERCEDES 91-24-16	REFER TO AD
	A	US	<u>92-09-05</u>	□	ENG DRIVESHAFT COUPLING ADAPTER	212-91-67	REFER TO AD
	A	US	<u>92-07-08</u>	□	SWASHPLATE SUPPORT ASSEMBLY	212-91-72	REFER TO AD
	A	US	<u>90-26-11</u>	□	MAIN ROTOR DRAG BRACE ASSEMBLY	212-90-59	REFER TO AD
	A	US	<u>90-03-09</u>	□	T / R TRUNNION BEARING HOUSING ASSEMBLY	212-86-39 REV A	REFER TO AD
	A	US	<u>89-08-05</u>	□	MAIN TRANSMISSION - SPIRAL BEVEL GEARS		REFER TO AD
	A	US	<u>86-17-09</u>	□	TAIL ROTOR TRUNNION BEARING HOUSING	212-86-39RA	REFER TO AD
	A	US	<u>81-19-01</u>	□	MAIN ROTOR YOKE	ASB 212-81-23	REFER TO AD
	A	US	<u>81-10-07</u>		SWASHPLATE SUPPORT	ASB 212-81-22	REFER

				□		TO AD
A	US	<u>80-21-05</u>		□	LANDING GEAR CROSS TUBES	REFER TO AD
A	US	<u>79-20-05</u>		□	MAIN ROTOR HUB ASSEMBLY	REFER TO AD
A	US	<u>79-05-08</u>		□	EMER FLOTATION (DITCHING) EQUIPMENT	REFER TO AD
A	US	<u>78-21-02</u>		□	EXTERNAL LOAD LINK ASSEMBLY	REFER TO AD
A	US	<u>78-20-07</u>		□	SHOULDER RADIUS FITTING	REFER TO AD
A	US	<u>78-17-03</u>		□	SPIRAL BEVEL GEAR	REFER TO AD
A	US	<u>78-14-07</u>		□	SKID LANDING GEAR	REFER TO AD
A	US	<u>78-09-02</u>		□	EMERGENCY FLOAT KITS	REFER TO AD
A	US	<u>77-17-05</u>		□	EMERGENCY EXIT LATCH PIN	REFER TO AD
A	US	<u>77-17-03</u>		□	TAIL ROTOR BLADE PITCH HORN	REFER TO AD
A	US	<u>77-10-05</u>		□	CRACKS IN MAIN ROTOR BLADES SKIN	REFER TO AD
A	US	<u>77-05-02</u>		□	MAIN ROTOR BLADES	REFER TO AD
A	US	<u>76-14-03</u>		□	CROSS TUBE ASSEMBLIES	REFER TO AD
A	US	<u>76-02-06</u>		□	MAIN ROTOR BLADES	REFER TO AD
A	US	<u>75-26-05</u>		□	MAIN ROTOR BLADES	REFER TO AD
A	US	<u>75-26-03</u>		□	EMERGENCY EXIT HANDLE	REFER TO AD
A	US	<u>75-07-01</u>		□	HIGH FREQUENCY VIBRATION	REFER TO AD

A	US	<u>74-20-05</u>	<input type="checkbox"/>	ELEVATOR MODIFICATION	REFER TO AD
A	US	<u>74-02-01</u>	<input type="checkbox"/>	TAIL ROTOR TRUNNION BEARINGS	REFER TO AD

Directives Pertaining to Aircraft Model: BELL TEXTRON - USA, 205A 1

New	Prod Type	Ctry.	AD Number	AD Subject	Service Bulletin or Reference	Repeat Insp.?
	A	CF	<u>CF-98-15</u>	<input type="checkbox"/> EXTERNAL RESCUE SYSTEMS	CAR 702.21	NO
	A	CF	<u>CF-96-06</u>	<input type="checkbox"/> EMERGENCY ESCAPE PANELS		YES
	A	CF	<u>CF-95-20R1</u>	<input type="checkbox"/> BOLTS OF FLIGHT CONTROL SERVO ACTUATORS	205-67-01	NO
	A	CF	<u>CF-94-07</u>	<input type="checkbox"/> ZINC PRIMER AS OVERHEAT INDICATOR	205-93-58 REV A	REFER TO AD
	A	CF	<u>CF-91-29R1</u>	<input type="checkbox"/> AFT FACING SEAT HEADRESTS		REFER TO AD
	A	CF	<u>CF-91-27</u>	<input type="checkbox"/> EMERGENCY ESCAPE RELEASE HANDLE COVERS		REFER TO AD
	A	CF	<u>CF-90-16R3</u>	<input type="checkbox"/> MAIN ROTOR YOKE	205-90-36 REV A	REFER TO AD
	A	CF	<u>CF-88-23R1</u>	<input type="checkbox"/> BLADE STRAP PINS	A8-27-45	REFER TO AD
	A	CF	<u>CF-77-03</u>	<input type="checkbox"/> 205A - ALIGNMENT BETWEEN ENGINE AND TRANSMISSION	205769	YES
	A	US	<u>2007-22-02</u>	<input type="checkbox"/> Tail rotor blade (blade) forward tip weight retention block (tip block) and the aft tip closure (tip closure)	205-00-80	REFER TO AD
	A	US	<u>2007-19-53</u>	<input type="checkbox"/> Missing Adhesive to the tip weight screws.	ASB 205-07-95	NO
	A	US	<u>2003-01-04</u>	<input type="checkbox"/> 204B, 205A /A-1/B, 212 - INSPECT MAIN ROTOR HUB	ASB 212-94-92 REV A	REFER TO AD

	A	US	<u>2002-22-14</u>		204B, 205A/B, 212, 214B/B1 - MAIN ROTOR TT STRAPS		REFER TO AD
	A	US	<u>2002-09-51</u>		TAIL ROTOR GRIPS		REFER TO AD
	A	US	<u>2001-13-01</u>		TAIL ROTOR COUNTERWEIGHT BELLCRANK RETENTION NUT	ASB 205-00-77RA	REFER TO AD
	A	US	<u>2001-08-04</u>		MAIN ROTOR ACTUATOR LOCKING WASHER	ASB 41105950-67A-01	REFER TO AD
	A	US	<u>2000-15-52</u>		MAIN ROTOR MAST/TRUNNION		REFER TO AD
	A	US	<u>99-18-02</u>		VERTICAL FIN SPAR CAP	ASB 205-98-70	REFER TO AD
	A	US	<u>99-17-03</u>		FAILURE OF TAILBOOM VERTICAL FIN SPAR	ASB 205-98-71 REV A	REFER TO AD
	A	US	<u>98-11-14</u>		TAIL ROTOR YOKE ASSY FAILURE	ASB205-96-68/69	REFER TO AD
	A	US	<u>94-18-09</u>		MAIN TRANSMISSION LOWER PLANETARY SPIDER	205-93-54	REFER TO AD
	A	US	<u>93-17-12</u>		MAIN ROTOR TRANSMISSION LOWER PLANETARY SPIDER	SUPERCEDES 92-11-07	REFER TO AD
	A	US	<u>92-27-21</u>		TAIL ROTOR DRIVE SHAFT	205-92-49	REFER TO AD
	A	US	<u>92-23-01</u>		PREVENT SEPERATION MAIN ROTOR PILLOW BLOCKS	205-90-38 REV A	REFER TO AD
	A	US	<u>92-13-10</u>		TAIL ROTOR DRIVESHAFT HANGER BEARINGS	SUPERCEDES 91-24-16	REFER TO AD
	A	US	<u>92-07-08</u>		SWASHPLATE SUPPORT ASSEMBLY	205-91-45	REFER TO AD
	A	US	<u>86-17-10</u>		TAIL ROTOR TRUNNION BEARING HOUSING	205-86-24RA	REFER TO AD
	A	US	<u>81-19-02</u>		MAIN ROTOR YOKE	ASB 204-81-11	REFER TO AD
	A	US	<u>80-21-05</u>		LANDING GEAR CROSS TUBES		REFER TO AD
	A	US	<u>79-20-05</u>		MAIN ROTOR HUB ASSEMBLY		REFER TO AD

A	US	<u>78-21-02</u>	EXTERNAL LOAD LINK ASSEMBLY	REFER TO AD
A	US	<u>78-20-07</u>	SHOULDER RADIUS FITTING	REFER TO AD
A	US	<u>78-14-07</u>	SKID LANDING GEAR	REFER TO AD
A	US	<u>77-17-05</u>	EMERGENCY EXIT LATCH PIN	REFER TO AD
A	US	<u>77-17-03</u>	TAIL ROTOR BLADE PITCH HORN	REFER TO AD
A	US	<u>77-10-07</u>	ENGINE-TO-TRANSMISSION ASSY	REFER TO AD
A	US	<u>76-14-03</u>	CROSS TUBE ASSEMBLIES	REFER TO AD
A	US	<u>76-12-07</u>	TAIL ROTOR CHAINS	YES
A	US	<u>76-10-01</u>	TAIL BOOM	REFER TO AD
A	US	<u>76-06-02</u>	FIRE EXTINGUISHER CIRCUIT	REFER TO AD
A	US	<u>76-02-06</u>	MAIN ROTOR BLADES	REFER TO AD
A	US	<u>75-26-05</u>	MAIN ROTOR BLADES	REFER TO AD
A	US	<u>75-26-03</u>	EMERGENCY EXIT HANDLE	REFER TO AD
A	US	<u>74-23-02</u>	TAIL ROTOR PITCH	REFER TO AD
A	US	<u>74-02-01</u>	TAIL ROTOR TRUNNION BEARINGS	REFER TO AD
A	US	<u>73-17-04</u>	TAIL ROTOR GRIPS	REFER TO AD
A	US	<u>73-16-03</u>	LANDING GEAR CROSS TUBES	REFER TO AD
A	US	<u>71-21-02</u>	TAIL FIN AND BOOM	REFER










TO AD

	A	US	<u>70-06-02</u>		TAIL ROTOR GRIP ASSY		REFER TO AD
	A	US	<u>69-15-07</u>		FLOAT KIT TUBE		REFER TO AD

All airworthiness directives applicable to:
Manufacturer: BELL TEXTRON - USA
Model: 205B




AD Record List

New	Model	Ctry.	AD Number		AD Subject	Service Bulletin or Reference	Repeat Insp.?
	205B	CF	<u>CF-88-23R1</u>		BLADE STRAP PINS	A8-27-45	REFER TO AD
	205B	CF	<u>CF-98-15</u>		EXTERNAL RESCUE SYSTEMS	CAR 702.21	NO
	205B	US	<u>2007-22-02</u>		Tail rotor blade (blade) forward tip weight retention block (tip block) and the aft tip closure (tip closure)	205B-00-34	REFER TO AD
	205B	US	<u>2007-19-53</u>		Missing Adhesive to the tip weight screws.	ASB 205B-07-46	NO
	205B	US	<u>2003-01-04</u>		204B, 205A /A-1/B, 212 - INSPECT MAIN ROTOR HUB	ASB 212-94-92 REV A	REFER TO AD
	205B	US	<u>2002-22-14</u>		204B, 205A/B, 212, 214B/B1 - MAIN ROTOR TT STRAPS		REFER TO AD
	205B	US	<u>2002-09-51</u>		TAIL ROTOR GRIPS		REFER TO AD
	205B	US	<u>2001-13-01</u>		TAIL ROTOR COUNTERWEIGHT BELLCRANK RETENTION NUT	ASB 205B-00-31RA	REFER TO AD
	205B	US	<u>2001-08-04</u>		MAIN ROTOR ACTUATOR LOCKING WASHER	ASB 41105950-67A-01	REFER TO AD
	205B	US	<u>2000-15-52</u>		MAIN ROTOR MAST/TRUNNION		REFER TO AD

205B	US	<u>99-18-02</u>		VERTICAL FIN SPAR CAP	ASB 205-98-70	REFER TO AD
205B	US	<u>98-11-14</u>		TAIL ROTOR YOKE ASSY FAILURE	ASB205-96-68/69	REFER TO AD
205B	US	<u>94-18-09</u>		MAIN TRANSMISSION LOWER PLANETARY SPIDER	412-93-72 REV A	REFER TO AD
205B	US	<u>93-17-12</u>		MAIN ROTOR TRANSMISSION LOWER PLANETARY SPIDER	SUPERCEDES 92-11-07	REFER TO AD
205B	US	<u>92-23-01</u>		PREVENT SEPERATION MAIN ROTOR PILLOW BLOCKS	212-90-62 REV A	REFER TO AD
205B	US	<u>92-13-10</u>		TAIL ROTOR DRIVESHAFT HANGER BEARINGS	SUPERCEDES 91-24-16	REFER TO AD
205B	US	<u>92-27-21</u>		TAIL ROTOR DRIVE SHAFT	205-92-49	REFER TO AD
205B	US	<u>92-07-08</u>		SWASHPLATE SUPPORT ASSEMBLY	204-91-32	REFER TO AD
205B	US	<u>81-19-02</u>		MAIN ROTOR YOKE	ASB 205-81-16	REFER TO AD

All airworthiness directives applicable to:
Manufacturer: BELL TEXTRON - CAN
Model: 412

AD Record List

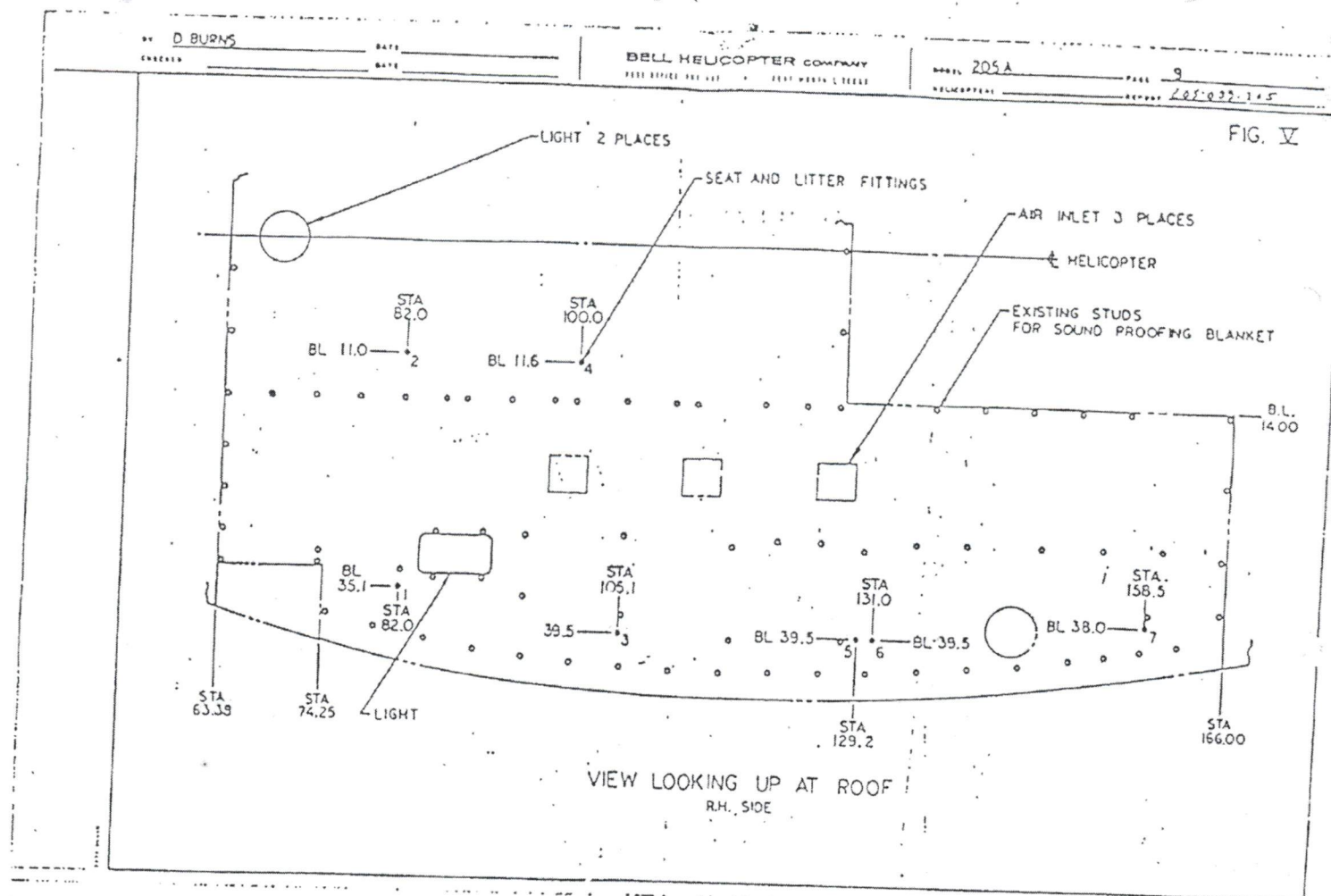
New	Model	Ctry	AD Number		AD Subject	Service Bulletin or Reference	Repeat Insp.?
	412	CF	<u>CF-94-07</u>		ZINC PRIMER AS OVERHEAT INDICATOR	412-93-79 REV A	REFER TO AD
	412	CF	<u>CF-95-20R1</u>		BOLTS OF FLIGHT CONTROL SERVO ACTUATORS	212-67-01	NO
	412	CF	<u>CF-98-15</u>		EXTERNAL RESCUE SYSTEMS	CAR 702.21	NO

412	US <u>2007-22-02</u>	Tail rotor blade (blade) forward tip weight retention block (tip block) and the aft tip closure (tip closure) REVISION A	412-00-106, AND 412CR-00-13,	REFER TO AD
412	US <u>2007-19-53</u>	Missing Adhesive to the tip weight screws.	ASB 412-07-123	NO
412	US <u>2001-22-14</u>	FIRE EXTINGUISHING SYSTEM BOTTLE CARTRIDGES INSTALLED TO WALTER KIDDE FIREX BOTTLES	OAS SB 22-09-97	REFER TO AD
412	US <u>2001-13-01</u>	TAIL ROTOR COUNTERWEIGHT BELLCRANK RETENTION NUT	ASB 412-00-102RA	REFER TO AD
412	US <u>2001-09-11</u>	TAIL ROTOR YOKE FATIGUE FAILURE	ASB 412-96-89	REFER TO AD
412	US <u>2001-08-04</u>	MAIN ROTOR ACTUATOR LOCKING WASHER	ASB 41105950-67A-01	REFER TO AD
412	US <u>2000-18-09</u>	TAILBOOM ATTACHMENT UPPER LH CAP ANGLE	412-00-100	REFER TO AD
412	US <u>99-23-23</u>	MAIN ROTOR YOKE	412-98-93	REFER TO AD
412	US <u>97-11-04</u>	MAST AND SPLINE PLATE FATIGUE	ASB 412-94-81 REV B	REFER TO AD
412	US <u>97-07-06</u>	SWASHPLATE SUPPORT ASSY	ASB 412-92-57/61	REFER TO AD
412	US <u>94-18-09</u>	MAIN TRANSMISSION LOWER PLANETARY SPIDER	412-93-72 REV A	REFER TO AD
412	US <u>93-17-12</u>	MAIN ROTOR TRANSMISSION LOWER PLANETARY SPIDER	SUPERCEDES 92-11-07	REFER TO AD
412	US <u>93-02-07</u>	VERTICAL FIN SPAR	412-92-65	REFER TO AD
412	US <u>92-13-10</u>	TAIL ROTOR DRIVESHAFT HANGER BEARINGS	SUPERCEDES 91-24-16	REFER TO AD
412	US <u>92-09-05</u>	ENG DRIVESHAFT COUPLING ADAPTER	412-91-53	REFER TO AD
412	US <u>82-26-51R1</u>	YOKE ASSEMBLIES SERVICE TIME	ASB 412-82-9	REFER TO AD
412	US <u>90-03-09</u>	T / R TRUNNION BEARING HOUSING ASSEMBLY	412-86-25 REV A	REFER TO AD
412	US <u>89-08-05</u>	MAIN TRANSMISSION - SPIRAL BEVEL GEARS		REFER TO AD

412	US	<u>86-16-11</u>	TAIL ROTOR TRUNNION BEARING HOUSING	412-86-25RA	REFER TO AD
412	US	<u>85-07-01</u>	MAIN ROTOR PITCH HORN	ASB 412-83-12 REV A	REFER TO AD

APPENDIX B - BELL HELICOPTERS RPT 205-099-205

Applicable Pages Only



BY _____

BELL HELICOPTER COMPANY
HAWAII OFFICE 800-441-1111 • HAWAII 800-441-1111

MODEL

205A

PAGE 11

CHECKED _____

RPT

212,214B

205-099-205

ROOF FITTINGS

POINT	LOAD CAPACITY (LBS ULT)				
	UP	DN	LONG.	LAT.	
1		1500	370	1130	*
2			1250	1250	Δ
3		1500			
4			1250	1250	Δ
5			1250	1250	Δ
6			1250	1250	Δ
7		1500			

* DO NOT COMBINE LONG. AND LAT. LOADS WITH 1500 LB DN LOAD. THE 1130 LB LOAD MAY BE APPLIED IN ANY DIRECTION IN THE LATERAL VERTICAL PLANE.

Δ APPLY THE LOAD IN ANY DIRECTION IN THE HORIZONTAL PLANE AS LONG AS THE NET LOAD RESULTANT DOES NOT EXCEED 1250 LBS.



BY P. CAPPELLI BILL HELICOPTER COMPANY MODEL UH-60A PAGE 10
 CHECKED _____ HELI. _____ RPT 205-C59-205

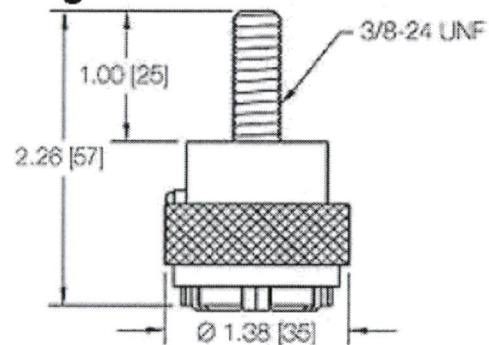
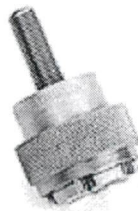
FLOOR FITTINGS Δ

POINT	LOAD CAPACITY (LBS ULT)			
	UP	DN	LONG.	LAT.
1	2500	2500	1700	1700
2				
3				
4	2500	2500	1700	1700
5	1250	1250	500	500
6				
7				
8	1250	1250	500	500
9	2150	2150	1250	1250
10				
11				
12				
13				
14				
15				
16	2150	2150	1250	1250
17	1250	1250	500	500
18	2150	2150	1250	1250
19	1250	1250	500	500
20	2150	2150	1250	1250
21	1250	1250	500	500
22	1250	1250	500	500
23	2150	2150	1250	1250
24	1250	1250	500	500
25	1250	1250	500	500
26	2150	2150	1250	1250
27				
28				
29				
30	2150	2150	1250	1250
31	1250	1250	500	500

Δ AT EACH POINT ANY SINGLE VERTICAL AND SINGLE HORIZONTAL LOAD MAY BE APPLIED SIMULTANEOUSLY

○ AT STUD ONLY, 2500 LBS MAY BE APPLIED VERTICALLY, UP OR DOWN OR WITHIN A 30° CONE FROM THE VERTICAL. 2150 LBS, UP OR DOWN, AND 1250 LBS HORIZONTAL LOAD HAVE A RESULTANT OF 2500 LBS AT AN ANGLE OF 30° FROM THE VERTICAL. THIS IS MAX ANGLE FOR APPLYING 2500 LBS.

APPENDIX C – 33115 ROOF ATTACHING HARDWARE SPECIFICATIONS

.....
12 Jaw Fitting with Threaded Stud 33115

12 Jaw Fitting with Threaded Stud

0° Vertical Breaking Strength: 5,475 lbs./2485 kgs.

90° Pull Angle Breaking Strength: 2,300 lbs./1045 kgs.

Weight: 0.22 lbs./ 0.10 kgs.

.....

AERO DESIGN LTD.

2013 - 39 Avenue N.E., Calgary, Alberta, T2E 6R7

Tel: 403-250-8027

Fax: 403-250-8333

www.aerodesign.ca

28 July, 2008

Transport Canada
Aircraft Certification Division
800-1601 Airport Road
Calgary, Alberta
T2E 6Z8

Attn: Greg Oucharek

Your File : C-08-0641

Our File : 808

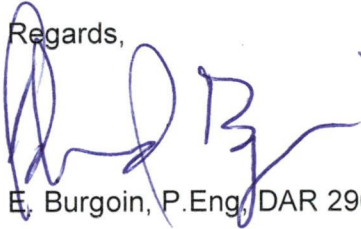
Re: Extension of Delegation

Greg,

Please extend my delegation to include the following paragraphs listed on compliance program CP758-1, Revision 1, CP758-2, Revision 2 and CP798, Revision 1.

29.251	Vibration
29.865(a)	External Loads
29.865(e)	External Loads

Regards,



E. Burgoin, P.Eng, DAR 290M

INSTRUCTIONS FOR CONTINUED AIRWORTHINESS ICA 758.90

Rappel Mount Provision

--

Cargo Deployment Arm

--

Rappel Step

Preface

These Instructions for Continued Airworthiness shall be included in the rotorcraft Maintenance Manual when;

- The Rappel Mount Provision assembled in accordance with AERO Design Ltd. Document Control List DCL758-1, Revision 3,
- The Cargo Deployment Arm assembled in accordance with AERO Design Ltd. Document Control List DCL792-1, Revision 3,
- The Rappel Step assembled in accordance with AERO Design Ltd. Document Control List DCL798-1, Revision 2, or later approved revision, is installed.

The information contained herein supplements the information in the basic Maintenance Manual. For Maintenance practices and procedures not contained in these Instructions for Continued Airworthiness refer to the basic Maintenance Manual and its approved supplements.

Revision 2

Original Date: 07 May, 2008

Revision Date: 30 December, 2008

AERO Design Ltd.
Engineering Consultants

2013 – 39th Avenue N.E., Calgary, Alberta T2E 6R7
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E-Mail: info@aerodesign.ca

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RECORD OF REVISIONS

Revision Number	Issue Date	Date Inserted	By
0			
1	16 June 2008	16 June 2008	R. Rathwell (Original Issue)
2	30 December 2008	30 December 2008	R. Rathwell

LIST OF EFFECTIVE PAGES

List of Revisions	Revision 1 (Original Issue)	16 June, 2008
	Revision 2	30 December, 2008

List of Effective Pages

<u>Description</u>	<u>Pages</u>	<u>Revision No.</u>
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Revision Record/List of Effective Pages	2	2
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04-00-00	7	2
05-00-00	8-15	2
11-00-00	16-17	2
25-00-00	18-36	2
APPENDIX A	37-43	2

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CHAPTER 0 – INTRODUCTION

0-1 SCOPE

The following Instructions for Continued Airworthiness (ICA) satisfy the requirements of 14 CFR 29.1529, and provide the information necessary to complete the on-going maintenance and inspections required for rotorcraft embodying the Rappel Mount Provision, Cargo Deployment Arm and Rappel Step as described herein.

0-2 DEFINITIONS AND ABBREVIATIONS

ICA -	Instructions for Continued Airworthiness
LH -	Left Hand
RH -	Right Hand
ID -	Inside Diameter
BELL-IPB	Bell Helicopters Illustrated Parts Book – Specific to each model

0-3 DISTRIBUTION

Copies of this ICA and amendments shall be distributed to all known purchasers of the Rappel Mount Provision, Cargo Deployment Arm and Rappel Step. Requests for a copy may be made in writing to:

AERO Design Ltd.
2013 39th Avenue N.E.
Calgary, Alberta
T2E 6R7
Fax: 403-250-8333
Email: info@aerodesign.ca

Any changes will be sent to Transport Canada. All changes will be recorded in the Record of Revisions page at the front of this document.

0-4 COMPATIBILITY

Prior to incorporating this modification, the installer shall establish that the inter-relationship between this change and any other modification(s) incorporated will not adversely affect the airworthiness of the helicopter.

0-5 GENERAL DESCRIPTION

Rappel Mount Provision

The Rappel Mount Provision Installation is a steel tube structure that mounts on the existing hardpoints of the helicopter roof structure.

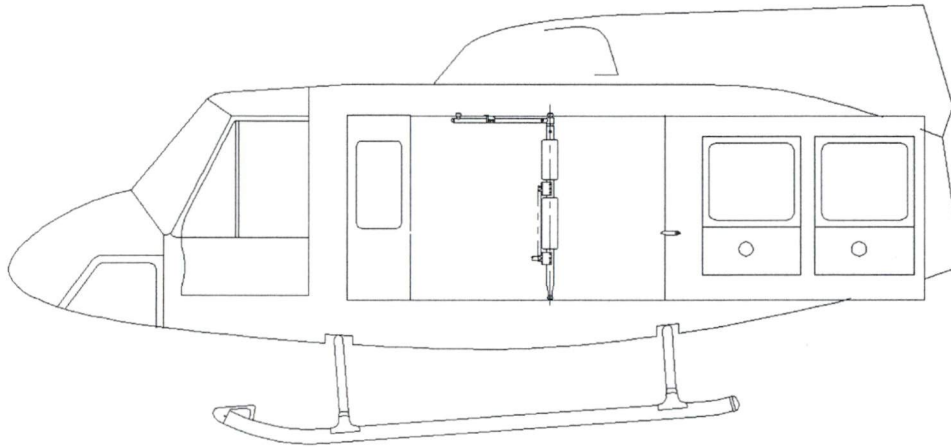


FIGURE 0-5-1 – RAPPEL MOUNT PROVISION INSTALLATION

Cargo Deployment Arm

The Cargo Deployment Arm Installation is an aluminum beam that mounts on the existing rear seat post stanchion of helicopter.

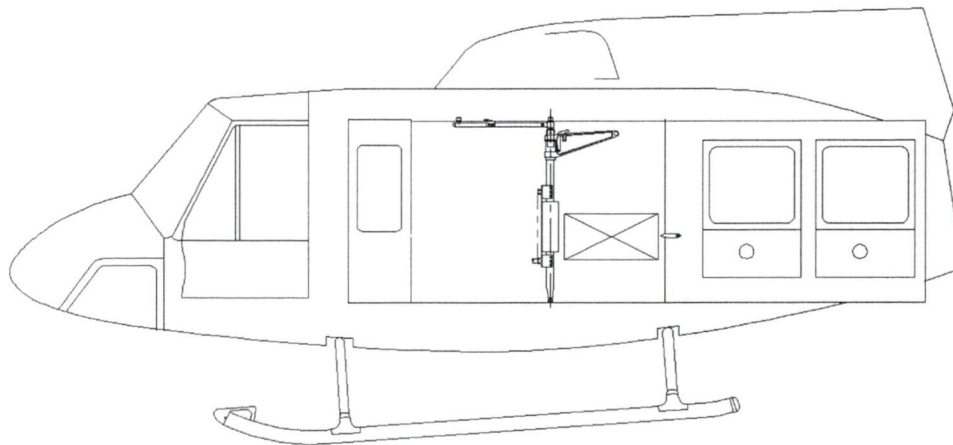


FIGURE 0-5-2 – CARGO DEPLOYMENT ARM INSTALLATION

Rappel Step

The Rappel Step Installation is an aluminum beam that attaches to the existing external hardpoints on the helicopter.

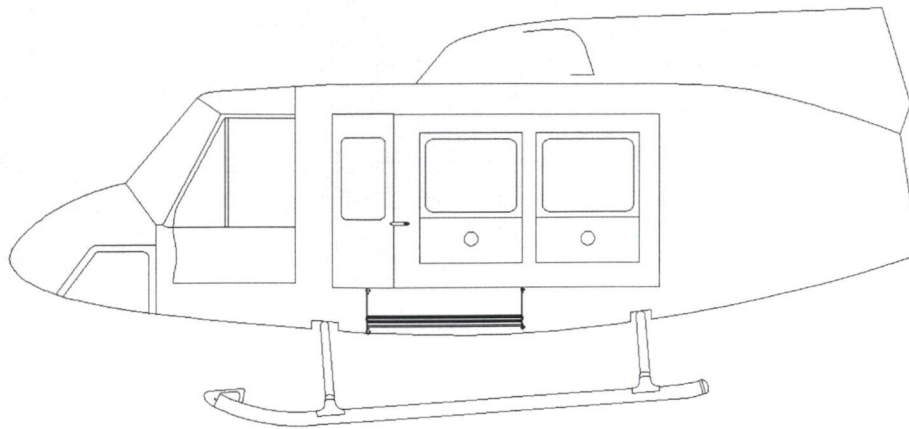


FIGURE 0-5-3 – RAPPEL STEP INSTALLATION

CHAPTER 4 - AIRWORTHINESS LIMITATIONS

The Airworthiness Limitations section is Transport Canada-approved and specifies maintenance required under Section 571 of the Canadian Aviation Regulations, unless an alternative program has been approved.

No additional airworthiness limitations have been imposed due the installation of the Rappel Mount Provision.

No additional airworthiness limitations have been imposed due the installation of the Cargo Deployment Arm.

No additional airworthiness limitations have been imposed due the installation of the Rappel Step.

CHAPTER 5 – INSPECTION REQUIREMENTS

5-1 INSPECTION SCHEDULE

Continued airworthiness is contingent upon compliance with the following inspection items. These items shall be completed in conjunction with the rotorcraft Maintenance Inspection schedule, or other approved program, or upon removal and replacement of any component of the Rappel Mount Provision, Cargo Deployment Arm or Rappel Step. Scheduled Inspections consist of:

1. Daily Inspections – Accomplished daily before flight operations, and
2. 300 Hour/180 Day Inspections – Accomplished each 300 hours of flight operation or after 180 calendar days, whichever comes first.

5-2 DAMAGE LIMITS / REPAIR INSTRUCTIONS

If damage is found in the inspections above, repair in accordance with the instructions below.

WARNING

DO NOT REPAIR DAMAGE TO THE RAPPEL MOUNT PROVISION, CARGO DEPLOYMENT ARM OR RAPPEL STEP IF BEYOND THE LIMITS BELOW.

DATA REFERENCE	INSPECTION TASK DESCRIPTION AND COMPONENT REPAIR/REPLACE ORDERS	INITIAL	
		MECH	OTHER
	RAPPEL MOUNT PROVISION		
	DAILY INSPECTION		
DRAWING 75801	<p>a. Inspect the attachment of the Rappel Mount Provision to the helicopter roof tiedown studs for condition and security. Ensure the stud fittings are fully engaged onto the helicopters roof tiedown studs and are locked.</p> <p>b. Inspect the gate mechanism for functionality. The gate should open smoothly and close automatically with the spring force only.</p>		
	300 HOUR/180 DAY INSPECTION		
DRAWING 75801 75820	<p><u>1. Rappel Mount Provision Installation:</u></p> <p>a. Visually inspect the security of the Rappel Mount Provision to the Stanchion Post. If assembly movement at the stanchion post is detected, inspect the stanchion post, bolt (p/n AN4-23A) and Stanchion Adapter (p/n 75833-01) for wear. Replace worn part.</p> <p>b. Visually inspect Stud Fittings. If cracked, corroded, worn or broken, replace part (p/n 33115 KINEDYNE).</p>		
BELL-IPB	c. Visually inspect Adapter (MS22034-2) at the bottom of the Stanchion Post. If cracked, corroded, worn or broken, replace part.		
BELL-IPB	d. Visually inspect the helicopter roof and floor tiedown studs associated with this installation. If cracked, corroded, worn or broken, replace part per Bell-IPB.		

DATA REFERENCE	INSPECTION TASK DESCRIPTION AND COMPONENT REPAIR/REPLACE ORDERS	INITIAL MECH	OTHER
DRAWING 75820	<p><u>2. Rappel Mount Provision Assembly:</u></p> <p>a. Visually inspect the fasteners, including the fastening of the stud fittings to the helicopter roof tiedown studs and the adapter at the bottom of the stanchion post to the helicopter floor tiedown stud for security and condition. Replace as necessary.</p> <p>b. Visually inspect the opening and closing operation of the gate mechanism;</p> <p>i. Gate mechanism must close automatically under the springs force only. Burrs and other sources of resistance may be dressed-out. Replace gate spring (p/n 24704 DYNALINE) if necessary.</p> <p>ii. Gate mechanism must open freely. Burrs and other sources of resistance may be dressed-out.</p> <p>c. Visually inspect the Retainer for cracks, corrosion or other damage. - Nicks and/or gouges up to 0.030" deep and 0.125" wide may be dressed out to a smooth contour.</p> <p>d. Visually inspect the all other aluminum components – Guide, Stanchion Adapter, and Curved Washer for cracks, corrosion or other damage. - Nicks and/or gouges up to 0.063" deep and 0.125" wide may be dressed out to a smooth contour.</p> <p>e. Visually inspect the Rappel Tube for cracks, corrosion or other damage - Nicks and/or gouges up to 0.030" deep and 0.125" wide may be dressed out to a smooth contour.</p> <p>f. Check all bolts for security and torque. Refer to Section 25-70.</p>		

DATA REFERENCE	INSPECTION TASK DESCRIPTION AND COMPONENT REPAIR/REPLACE ORDERS	INITIAL MECH	OTHER
DRAWING 79201 79220	<p>CARGO DEPLOYMENT ARM</p> <p>DAILY INSPECTION</p> <p>a. Inspect the attachment of the seat post stanchion to the helicopter tiedown studs for condition and security. Ensure the floor adapter is fully engaged onto the helicopter floor tiedown stud and is locked. Ensure the stud fittings are fully engaged onto the helicopters roof tiedown studs and are locked.</p> <p>b. Inspect the locking leaver for functionality. The leaver should open smoothly and close automatically with the spring only.</p> <p>c. Inspect the pivoting of the Cargo Deployment Arm. The Cargo Arm should pivot smoothly about the seat post stanchion.</p>		
	<p>300 HOUR/180 DAY INSPECTION</p> <p><u>1. Cargo Deployment Arm Installation;</u></p> <p>a. Visually inspect the security of the Cargo Deployment Arm to the Stanchion Post. When locked, the cargo arm sideward motion limit at the furthest point from the stanchion is +/- 0.25". If this motion is detected, inspect the stanchion post, bolt (p/n AN4-32A/-26A), Locking Leaver (p/n 79235-01) and Bearing Sleeve (p/n 79231-01) for wear. Replace worn part.</p> <p>b. Visually inspect the Stud Fittings. If cracked, corroded, worn or broken, replace part (p/n 33115 KINEDYNE).</p> <p>c. Visually inspect Adapter (MS22034-2) at the bottom of the Stanchion Post. If cracked, corroded, worn or broken, replace part.</p> <p>d. Visually inspect the helicopter roof and floor tiedown studs associated with this installation. If cracked, corroded, worn or broken, replace part per Bell-IPB.</p> <p><u>2. Stanchion Post;</u></p> <p>a. Visually inspect the Seat Post Stanchion for cracks, corrosion or other damage.</p>		
BELL-IPB			
BELL-IPB			

DATA REFERENCE	INSPECTION TASK DESCRIPTION AND COMPONENT REPAIR/REPLACE ORDERS	INITIAL MECH	INITIAL OTHER
DRAWING 79220	<p>3. Cargo Deployment Arm Assembly;</p> <p>a. Bushing – 79233-01 and 79233-02;</p> <p> a) Bushing must not rotate or move within the aluminum cargo arm.</p> <p> b) [REMOVED]</p> <p> c) Visually inspect the bushing for cracks, corrosion or other damage - Nicks and/or gouges up to 0.030" deep and 0.125" wide may be dressed out to a smooth contour.</p> <p>b. Locking Mechanism;</p> <p> a) Visually inspect the locking operation for the deployed and stowed position;</p> <p> i. Locking Leaver must engage automatically under the locking springs force. Burrs and other sources of resistance may be dressed-out. Replace Locking Spring (p/n 24704 DYNALINE) and Ball Bearing (Dia. 0.500in) if necessary.</p> <p> ii. Locking Leaver must disengage with little resistance. Burrs and other sources of resistance may be dressed-out.</p> <p> iii. Locking Leaver must rotate smoothly about the locking leaver bushing. Replace bushing (p/n 79237-02), bushing (p/n 79237-01), bolt (p/n AN4-11A) if worn.</p> <p> iv. Engagement of the Locking Leaver into the Bearing Sleeve must prevent the cargo arm from pivoting about the Bearing Sleeve. When locked, the cargo arm sideward motion limit at the furthest point from the bearing sleeve is +/- 0.25". If this motion is detected, inspect the Locking Leaver (p/n 79235-01) and Bearing Sleeve (p/n 79231-01) for wear. Replace worn part.</p> <p> v. Touch up aluminum components with polyurethane paint as required following repairs.</p> <p>c. Visually inspect Nylon Bushing (p/n 79233-01);</p> <p> a) Minimum wall thickness - 0.100in</p> <p> b) If gouges are detected, inspect mating parts for burrs and contaminates. Replace nylon bushing if gouge exceeds minimum wall thickness allowable.</p> <p>d. Visually inspect Nylon Bushing (p/n 79234-01).</p> <p> a) Minimum wall thickness - 0.100in</p> <p> b) If gouges and detected, inspect mating parts for burrs and contaminates. Replace nylon bushing of gouge exceeds minimum wall thickness allowable.</p>		

DATA REFERENCE	INSPECTION TASK DESCRIPTION AND COMPONENT REPAIR/REPLACE ORDERS	INITIAL	
		MECH	OTHER
DRAWING 79220	<p>e. Visually inspect the Aluminum Cargo Arm (beam) for cracks, corrosion or other damage;</p> <p>a) Flange and Stanchion Post Lugs - Nicks and/or gouges up to 0.063" deep and 0.125" wide may be dressed out to a smooth contour.</p> <p>b) Web - Nicks and/or gouges up to 0.030" deep and 0.125" wide may be dressed out to a smooth contour.</p> <p>c) Touch up with polyurethane paint as required following repairs.</p> <p>f. Visually inspect the Bearing Sleeve for cracks, corrosion or other damage - Nicks and/or gouges up to 0.030" deep and 0.125" wide may be dressed out to a smooth contour.</p> <p>g. Check all bolts for security and torque. Refer to Section 25-70</p>		

DATA REFERENCE	INSPECTION TASK DESCRIPTION AND COMPONENT REPAIR/REPLACE ORDERS	INITIAL	
		MECH	OTHER
	RAPPEL STEP		
	DAILY INSPECTION		
DRAWING 79801	a. Inspect the attachment of the Rappel Step to the helicopter hardpoints.		
	300 HOUR/180 DAY INSPECTION		
DRAWING 79820	<u>1. Rappel Step Assembly:</u> a. Visually inspect all components for cracks, corrosion or other damage. Aluminum parts - Nicks and/or gouges up to 0.063" deep and 0.25" wide may be dressed out to a smooth contour. Replace attachment hardware if worn. b. Check all bolts for security and torque. Refer to Section 25-70.		

5-3 PROTECTIVE TREATMENT INFORMATION

1. Rappel Mount Provision

The Rappel Mount Provision is supplied painted white. If the paint is damaged, touch up with white polyurethane paint.

2. Cargo Deployment Arm

The Cargo Deployment Arm is supplied painted white. If the paint is damaged, touch up with white polyurethane paint.

3. Rappel Step

The Rappel Step is supplied painted white. If the paint is damaged, touch up with white polyurethane paint.

CHAPTER 11 – MARKINGS AND PLACARDS

The following markings and placards are used with the **Rappel Mount Provision Installation** in the locations noted:

Placards 75837-01 and 75837-02 to be in clear view of the pilot

**AIRCRAFT MUST BE IN HOVER
FOR RAPPEL OPERATIONS**

Placard 75837-01

**RAPPEL OPERATIONS DURING
VFR CONDITIONS ONLY**

Placard 75837-02

Placard 75837-03 to be attached to Rappel Mount Provision in clear view of the load master.

**MAXIMUM RAPPEL MOUNT CAPACITY
350 LBS
(158 KG)**

Placard 75837-03

The following markings and placards are used with the **Cargo Deployment Arm Installation** in the locations noted:

Placards 79238-01 and 79238-02 to be in clear view of the pilot

**AIRCRAFT MUST BE IN HOVER FOR
CARGO DEPLOYMENT OPERATIONS**

Placard 79238-01

**CARGO DEPLOYMENT OPERATIONS
DURING VFR CONDITIONS ONLY**

Placard 79238-02

The following placard is engraved onto both sides of the Cargo Deployment Arm:

**MAXIMUM CARGO DEPLOYMENT ARM
CAPACITY
250 LB (113.3 KG)**

Placarding is not required for the **Rappel Step Installation**.

CHAPTER 25 – EQUIPMENT AND FURNISHINGS

25-60 – RAPPEL MOUNT PROVISION

The Rappel Mount Provision is installed in two steps. The first step is to combine the Rappel Mount Assembly (p/n 75820-01/-02) with the existing stanchion post to make the Rappel Mount Installation Assembly. The second step is to then install the Rappel Mount Installation Assembly into the helicopter. The removal of the installation is the reverse of these two steps.

The Rappel Mount Provision Installation may be applied to the right and/or left side of the helicopter.

25-61 RAPPEL MOUNT PROVISION – REMOVAL**A. RAPPEL MOUNT PROVISION INSTALLATION REMOVAL**

Refer to Drawing 75801, Figure 25-61A-1 and Figure 25-61A-2.

1. Remove the two MS35265-47 screws that fasten the bearing ring together. Remove bearing ring from the stanchion adapter.
2. At each roof stud fitting, remove the two MS35265-45 screws that fasten the guard rings together. Remove the guard rings.
3. Unlock the rappel mount provision stud fittings from the helicopter roof tiedown studs. Unlock the stud fitting located at the bottom of the stanchion post from the helicopter floor tiedown stud.
4. Loosen the AN4-23A bolt and the MS21043-4 locknut located near the top of the stanchion post.
5. Slide the stanchion adapter into the stanchion post and remove the Rappel Mount Installation Assembly from the helicopter.
6. Disassemble the Rappel Mount Installation Assembly (See Section 25-61B).

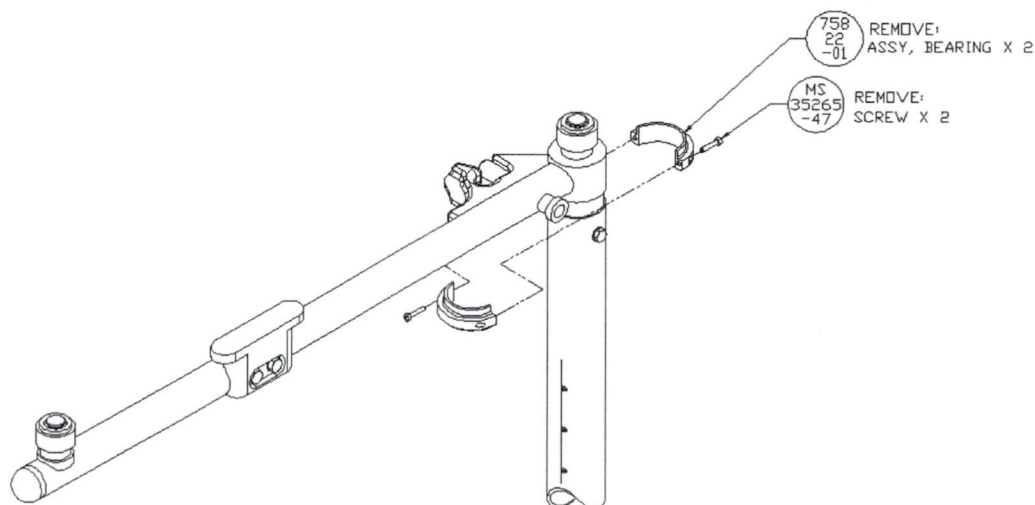


FIGURE 25-61A-1
REMOVAL OF BEARING RING

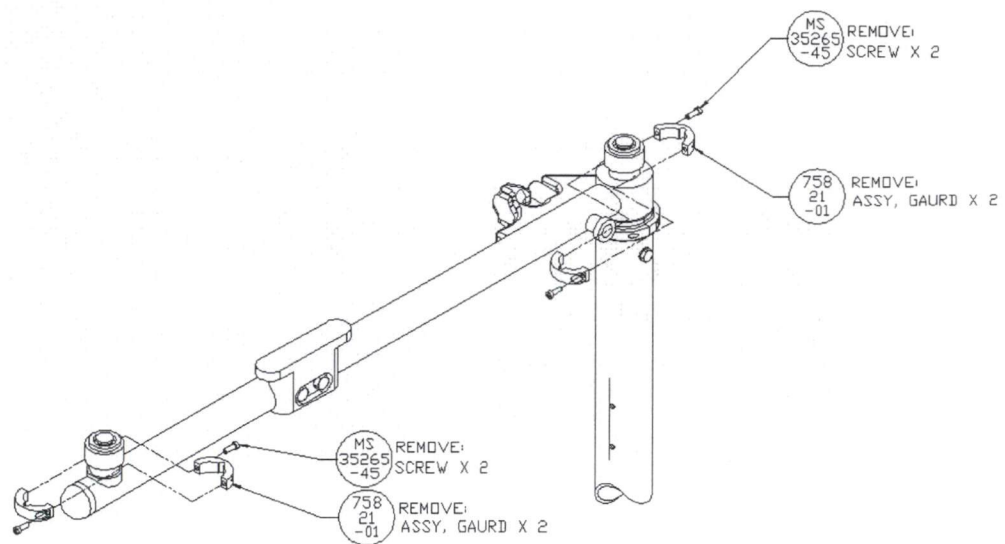


FIGURE 25-61A-2
REMOVAL OF GUARD RINGS

B. RAPPEL MOUNT INSTALLATION ASSEMBLY DISASSEMBLY

Refer to Drawing 75801 and Figure 25-61B-1.

1. Disconnect and remove the AN4-23A bolt and the MS21043-4 locknut located near the top of the stanchion post.
2. Remove the Rappel Mount Assembly from the stanchion post.
3. Insert the stanchion post adapter (Bell p/n 205-072-706-001) into the top of the stanchion post. Fasten together with an AN4-24A bolt, NAS1149D0463J washer and MS21042L4 locknut.

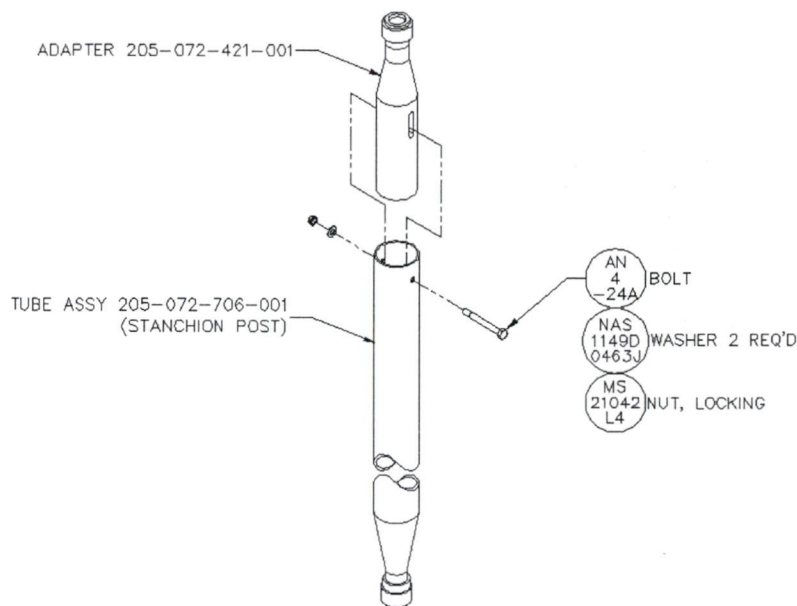


FIGURE 25-61B-1
INSTALLATION OF ADAPTER INTO STANCHION POST

25-62 RAPPEL MOUNT PROVISION – INSTALLATION**A. RAPPEL MOUNT INSTALLATION ASSEMBLY**

Refer to Drawing 75801, Figure 25-62A-1 and Figure 25-62A-2.

1. Remove the existing stanchion adapter (Bell p/n 205-072-706-001) from the helicopter stanchion post. Other stanchion post components such as the seat fittings and pads may remain.
2. Slide the stanchion adapter of the rappel mount provision assembly into the stanchion post. Align the stanchion adapter slot and stanchion post bolt hole.
3. Loosely fasten together with an AN4-23A bolt, AN960-416 washer and MS21043-4 locknut.

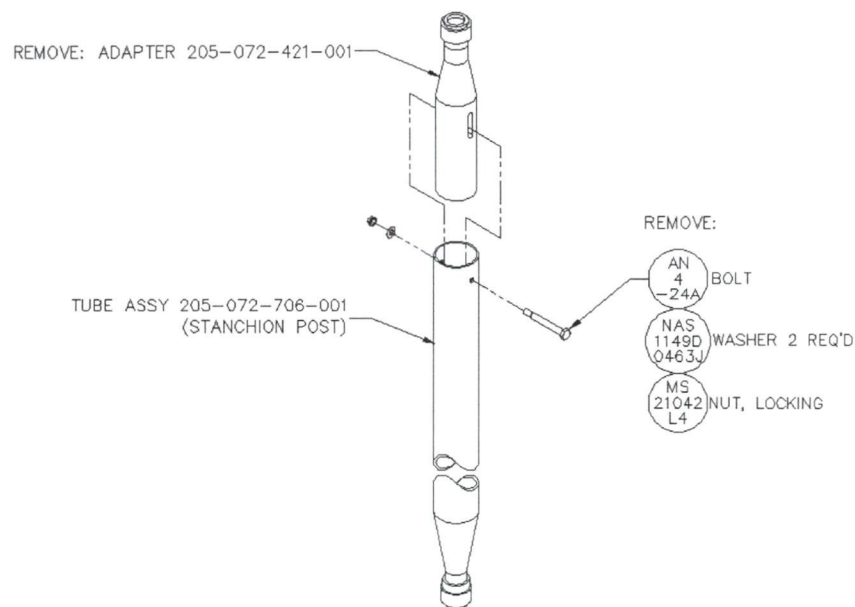


FIGURE 25-62A-1
REMOVAL OF ADAPTER FROM STANCHION POST

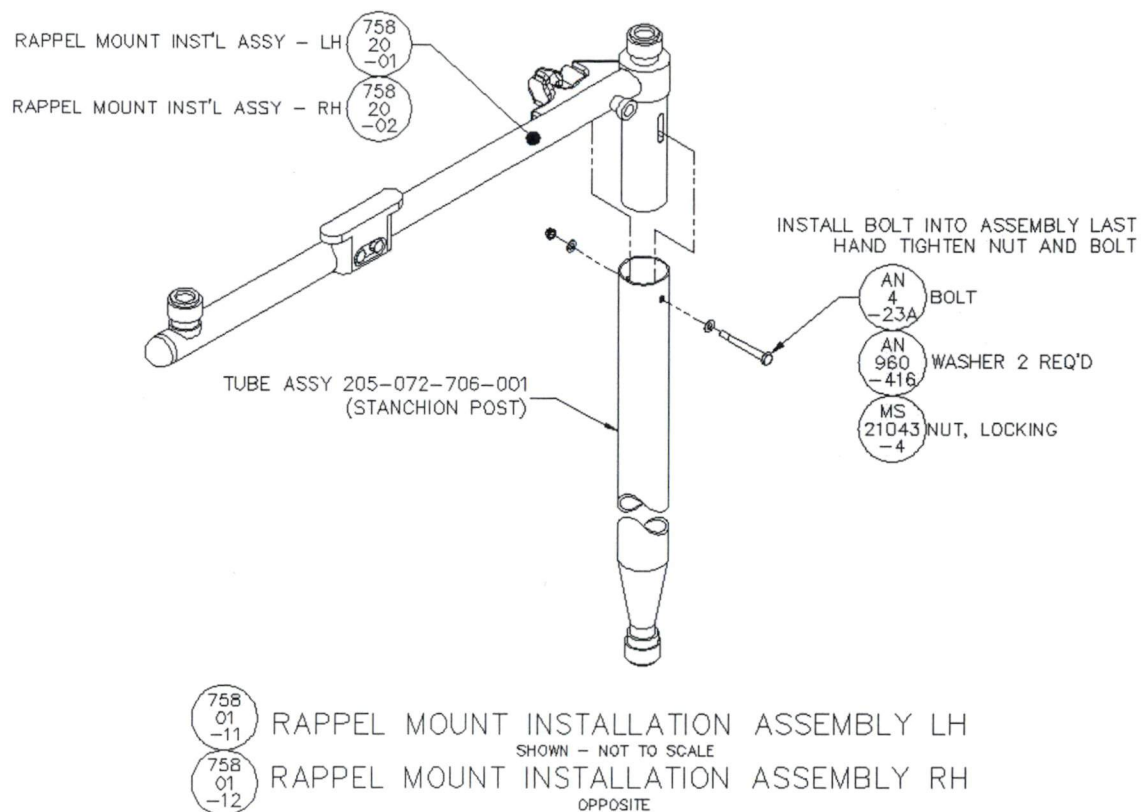


FIGURE 25-62A-2

INSTALLATION OF RAPPEL MOUNT ASSEMBLY INTO STANCHION POST

B. RAPPEL MOUNT INSTALLATION

Refer to Drawing 75801, Figure 25-62B-1 and Figure 25-62B-2.

1. Position the Rappel Mount Installation Assembly into the helicopter. Position and lock the stud fitting located on the bottom of the stanchion post onto the helicopter floor tiedown stud (position F.S. 131.0, B.L. 39.5). Position and lock the stud fittings located on the top of the rappel mount assembly onto the helicopter roof tiedown studs (position F.S. 105.1, B.L. 39.5 and F.S. 131.0, B.L. 39.5). See Aero Design Drawing 75801 for position details. Install the bearing ring with MS35265-47 screws around the stanchion adapter. Modifying the Bearing Ring for Fit:
 - a. With the Rappel Mount Installation Assembly Positioned into the helicopter, push the rappel mount provision assembly up and the stanchion post down. Then measure the gap between the stanchion adapter and the top of the stanchion post, as shown in Figure 25-62B-1.
 - b. If required, grind down the top bearing surface of the bearing ring to fit the gap between the stanchion adapter and the top of the stanchion post.
2. Install the guard rings around the roof stud fittings with MS23265-45 screws.
3. Tighten the AN4-23A bolt MS20365-428 locknut near the top of the stanchion post. See Section 25-70 for Torque Values.

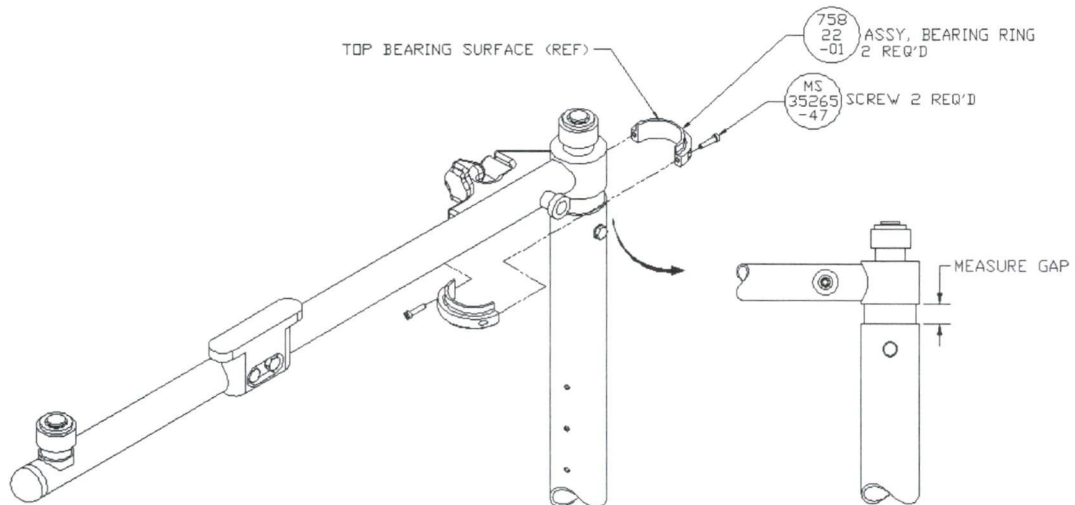


FIGURE 25-62B-1
INSTALLATION OF BEARING RING

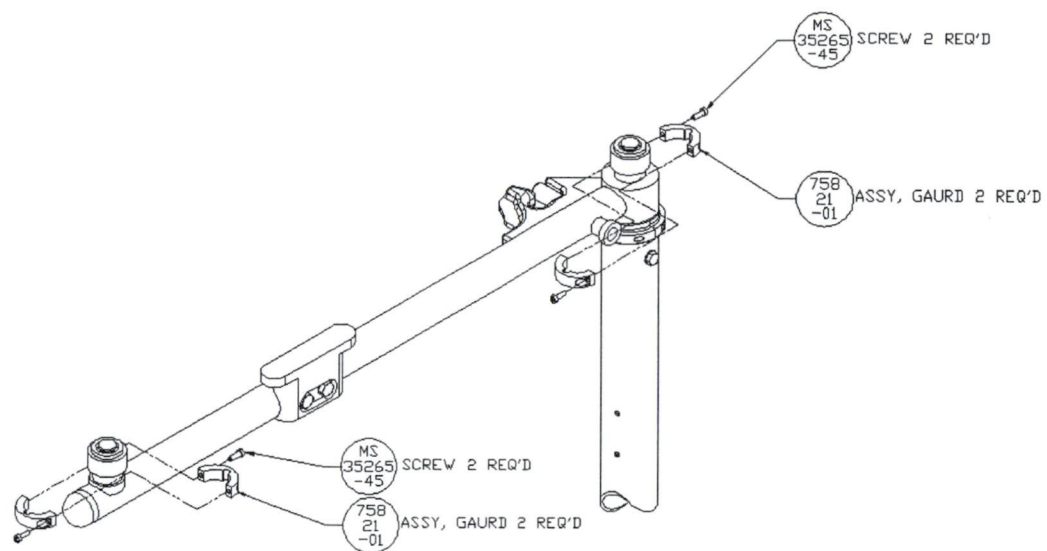


FIGURE 25-62B-2
INSTALLATION OF GUARD RINGS

25-63 CARGO DEPLOYMENT ARM

The Cargo Deployment Arm is installed in two steps. The first step is to combine the Cargo Arm Assembly, Rappel Mount Assembly with the existing stanchion post to make the Cargo Arm Installation Assembly. The second step is to then install the Cargo Arm Installation Assembly into the helicopter. The removal of the installation is the reverse of these two steps.

The Cargo Deployment Arm Installation may be applied to the right and/or left side of the helicopter.

25-64 CARGO DEPLOYMENT ARM – REMOVAL**A. CARGO DEPLOYMENT ARM INSTALLATION REMOVAL**

Refer to Drawing 79201, Figure 25-64A-1 and Figure 25-64A-2.

1. Remove the two MS35265-47 screws that fasten the bearing ring together. Remove bearing ring from the stanchion adapter.
2. At each roof stud fitting, remove the two MS35265-45 screws that fasten the guard rings together. Remove the guard rings.
3. Unlock the rappel mount provision stud fittings from the helicopter roof tiedown studs. Unlock the stud fitting located at the bottom of the stanchion post from the helicopter floor tiedown stud.
4. Loosen the AN4-32A bolt (or AN4-36A bolt if Bracket 80120-01 is installed) and the MS21043-4 locknut located near the top of the stanchion post.
5. Slide the stanchion adapter into the stanchion post and remove the Cargo Arm Installation Assembly from the helicopter.
6. Disassemble the Cargo Arm Installation Assembly (See Section 25-64B).

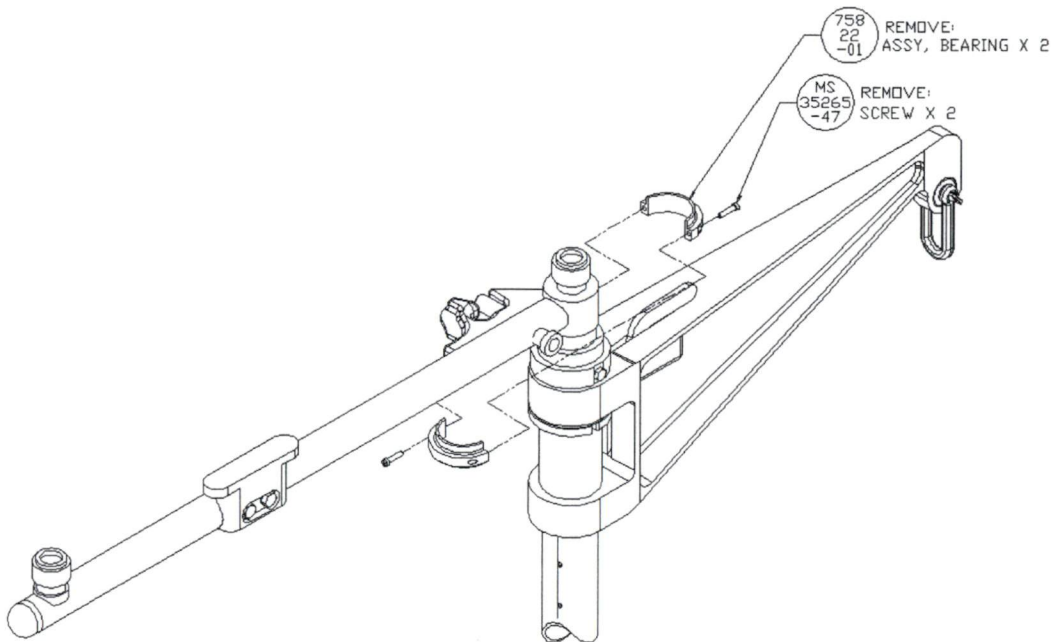


FIGURE 25-64A-1
REMOVAL OF BEARING RING

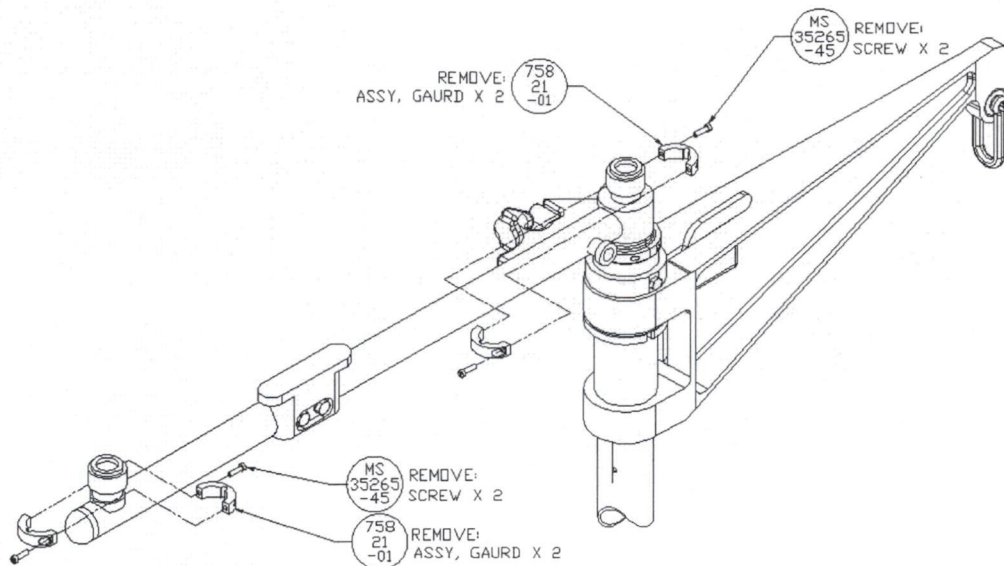


FIGURE 25-64A-2
REMOVAL OF GUARD RINGS

B. CARGO ARM INSTALLATION ASSEMBLY DISASSEMBLY

Refer to Drawing 79201 and Figure 25-64B-1.

1. Disconnect and remove the AN4-32A bolt (or AN4-36A bolt if Bracket 80120-01 is installed) and the MS21043-4 locknut located near the top of the stanchion post.
2. Remove the Rappel Mount Assembly and Cargo Arm Assembly from the stanchion post.
3. Replace the Pad Assembly (Bell p/n 205-072-707-001) onto the stanchion post.
4. Insert the stanchion post adapter (Bell p/n 205-072-706-001) into the top of the stanchion post. Fasten together with an AN4-24A bolt, NAS1149D0463J washer and MS21042L4 locknut.

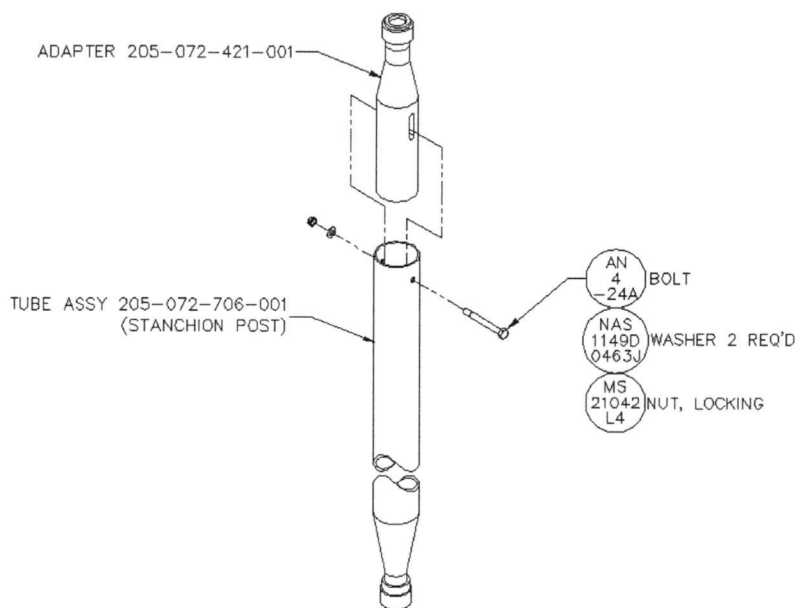


FIGURE 25-64B-1
INSTALLATION OF ADAPTER INTO STANCHION POST

25-65 CARGO DEPLOYMENT ARM – INSTALLATION**A. CARGO ARM INSTALLATION ASSEMBLY**

Refer to Drawing 79201, Figure 25-65A-1 and Figure 25-65A-2.

1. Remove the existing stanchion Adapter (Bell p/n 205-072-706-001) and Pad Assembly (Bell p/n 205-072-707-001) from the helicopter stanchion post. Other stanchion post components such as the seat fittings and the lower pad assembly may remain.
2. Slide the Cargo Arm Assembly onto the top portion of the stanchion post.
3. Slide the stanchion adapter of the Rappel Mount Provision Assembly into the stanchion post. Align the stanchion adapter slot, the stanchion post bolt hole and the Cargo Arm Assembly bolts hole.
4. Loosely fasten together with an AN4-32A bolt (or AN4-36A bolt if Bracket 80120-01 is installed), AN960-416 washer and MS21043-4 locknut.

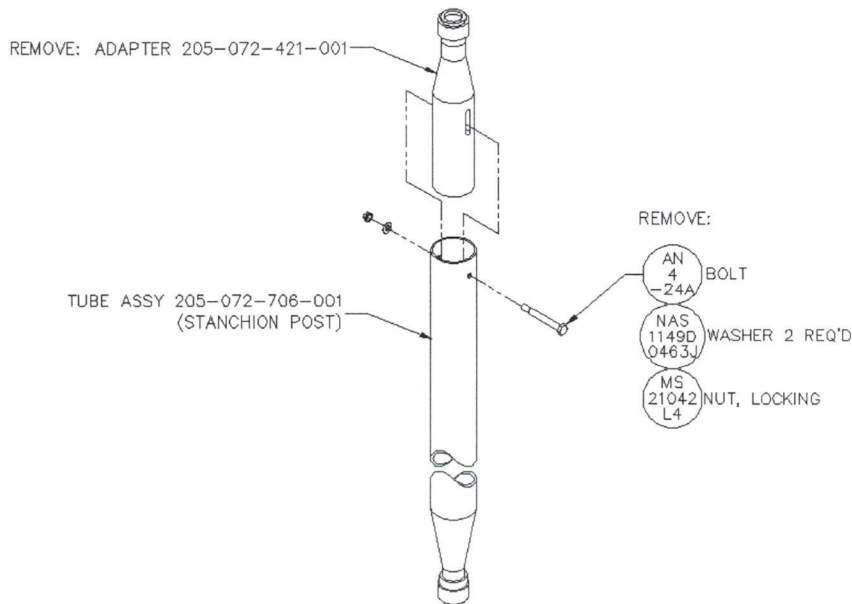


FIGURE 25-65A-1
REMOVAL OF ADAPTER FROM STANCHION POST

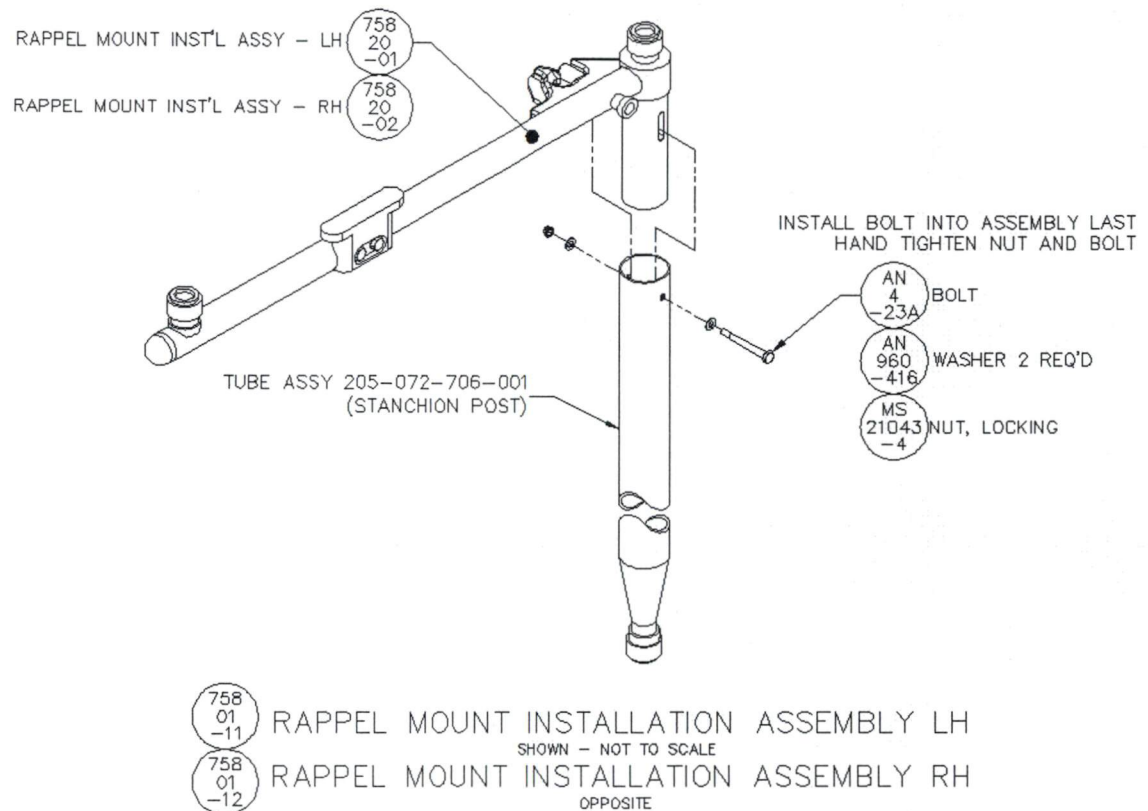


FIGURE 25-65A-2

INSTALLATION OF CARGO ARM ASSEMBLY AND RAPPEL MOUNT
 ASSEMBLY INTO THE STANCHION POST

B. CARGO DEPLOYMENT ARM INSTALLATION

Refer to Drawing 79201, Figure 25-65B-1 and Figure 25-65B-2.

WARNING

THE LHS SIDEWARD FACING SEATS MUST BE REMOVED WHEN INSTALLING THE CARGO DEPLOYMENT ARM ON THE LHS OF THE HELICOPTER.

THE RHS SIDEWARD FACING SEATS MUST BE REMOVED WHEN INSTALLING THE CARGO DEPLOYMENT ARM ON THE RHS OF THE HELICOPTER.

1. Position the Cargo Arm Installation Assembly into the helicopter. Position and lock the stud fitting located on the bottom of the stanchion post onto the helicopter floor tiedown stud (position F.S. 131.0, B.L. 39.5). Position and lock the stud fittings located on the top of the rappel mount assembly onto the helicopter roof tiedown studs (position F.S. 105.1, B.L. 39.5 and F.S. 131.0, B.L. 39.5). See Aero Design Drawing 79201 for position details.
2. Install the bearing ring with MS35265-47 screws around the stanchion adapter. Modifying the Bearing Ring for Fit:
 - c. With the Cargo Arm Installation Assembly Positioned into the helicopter, push the rappel mount provision assembly up and the stanchion post down. Then measure the gap between the stanchion adapter and the top of the bearing sleeve, as shown in Figure 25-65B-1.
 - d. If required, grind down the top bearing surface of the bearing ring to fit the gap between the stanchion adapter and the top of the bearing sleeve.
3. Install the guard rings around the roof stud fittings with MS23265-45 screws.
4. Tighten the AN4-32A bolt (or AN4-36A bolt if Bracket 80120-01 is installed) MS20365-428 locknut near the top of the stanchion post. See Section 25-70 for Torque Values.

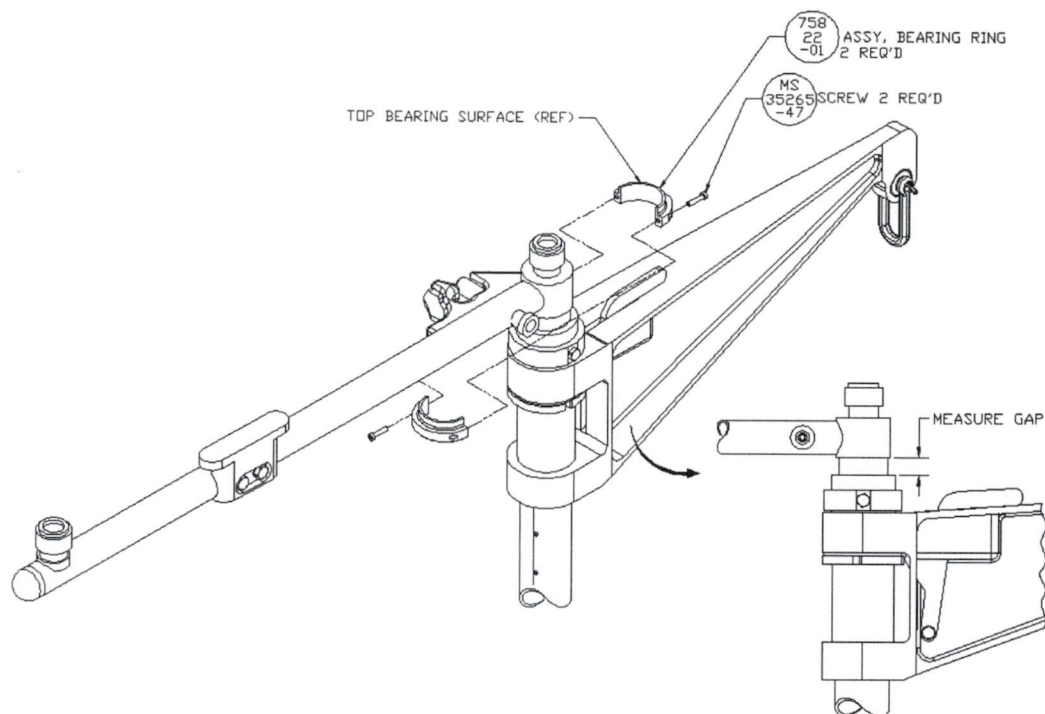


FIGURE 25-65B-1
INSTALLATION OF BEARING RING

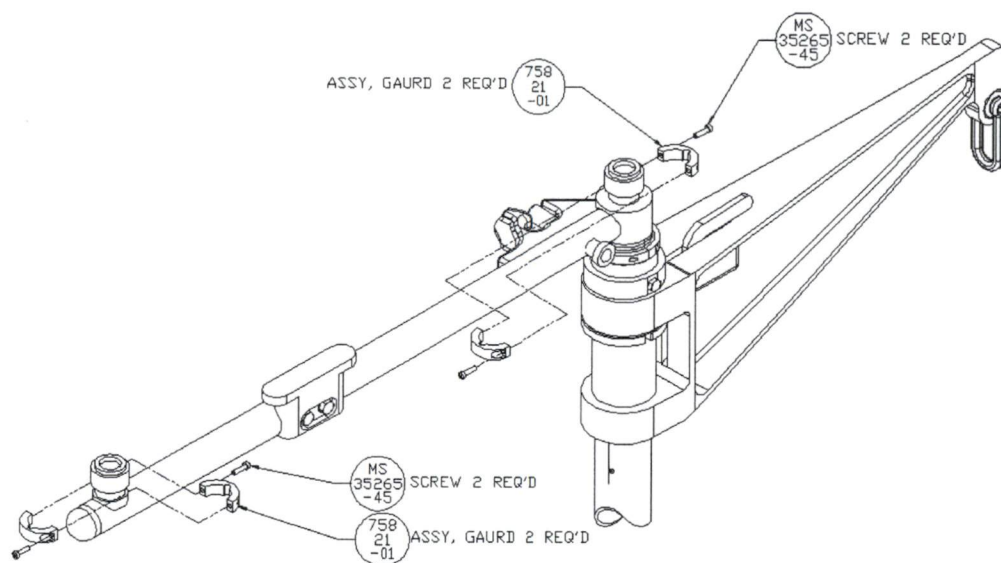


FIGURE 25-65B-1
INSTALLATION OF GUARD RINGS

25-66 RAPPEL STEP

The Rappel Step Installation may be applied to the right and/or left side of the helicopter.

25-67 RAPPEL STEP – REMOVAL

Refer to Drawing 79801, and Drawing 79820.

1. Remove the AN5 bolts (x2), AN960-516 washers (x2) and MS20365-524 locknuts (x2) from the mounting plate and the helicopter hardpoints at Fuselage Station 84.46.
2. Remove the AN4 bolts (x2), AN960-416 washers (x2) and MS20365-428 locknuts (x2) from the mounting plate and the helicopter hardpoints at Fuselage Station 129.00.
3. Remove the Rappel Step from the helicopter.

25-68 RAPPEL STEP – INSTALLATION

Refer to Drawing 79801, and Drawing 79820.

4. Align the rappel step bolt holes with the pairs of helicopter hardpoints at Fuselage Station 84.46 and 129.00. Ensure the rappel step mounting plates are on the forward side of the helicopter hardpoints.
5. Install the AN4 bolts (x2), through the pair of helicopter hardpoints and mounting plate at Fuselage Station 129.00. Secure with AN960-416 washers (x2) and MS20365-428 locknuts (x2). See Section 25-70 for Torque Values.
6. Install the AN5 bolts (x2), through the pair of helicopter hardpoints and mounting plate at Fuselage Station 84.46. Secure with AN960-516 washers (x2) and MS20365-524 locknuts (x2). See Section 25-70 for Torque Values.

25-69 WEIGHT AND BALANCE

Rappel Mount Provision Installation		Weight (lbs)	Longitudinal		Lateral	
Part #	Name		Arm (in)	Moment (in-lbs)	Arm (in)	Moment (in-lbs)
75801-01	Rappel Mount Provision Installation LHS	7.63	120.4	918.6	-39.5	-301.4
75801-02	Rappel Mount Provision Installation RHS	7.63	120.4	918.6	39.5	301.4

Cargo Deployment Arm Installation		Weight (lbs)	Longitudinal		Lateral	
Part #	Name		Arm (in)	Moment (in-lbs)	Arm (in)	Moment (in-lbs)
79201-01	Cargo Deployment Arm Installation LH	12.23	126.0	1541.0	-39.5	-483.1
79201-02	Cargo Deployment Arm Installation RH	12.23	126.0	1541.0	39.5	483.1

Note: The weight and balance data for the removal of sideward facing seats not included.

Rappel Step Installation		Weight (lbs)	Longitudinal		Lateral	
Part #	Name		Arm (in)	Moment (in-lbs)	Arm (in)	Moment (in-lbs)
79801-01	Rappel Step Installation LHS	9.5	105.22	999.58	-45.18	-429.20
79801-02	Rappel Step Installation RHS	9.5	105.22	999.58	45.18	429.20

Note: Lateral arms are given for right side installation. For installation on left side, lateral arms are negative.

25-70 STRUCTURAL FASTENER DATA

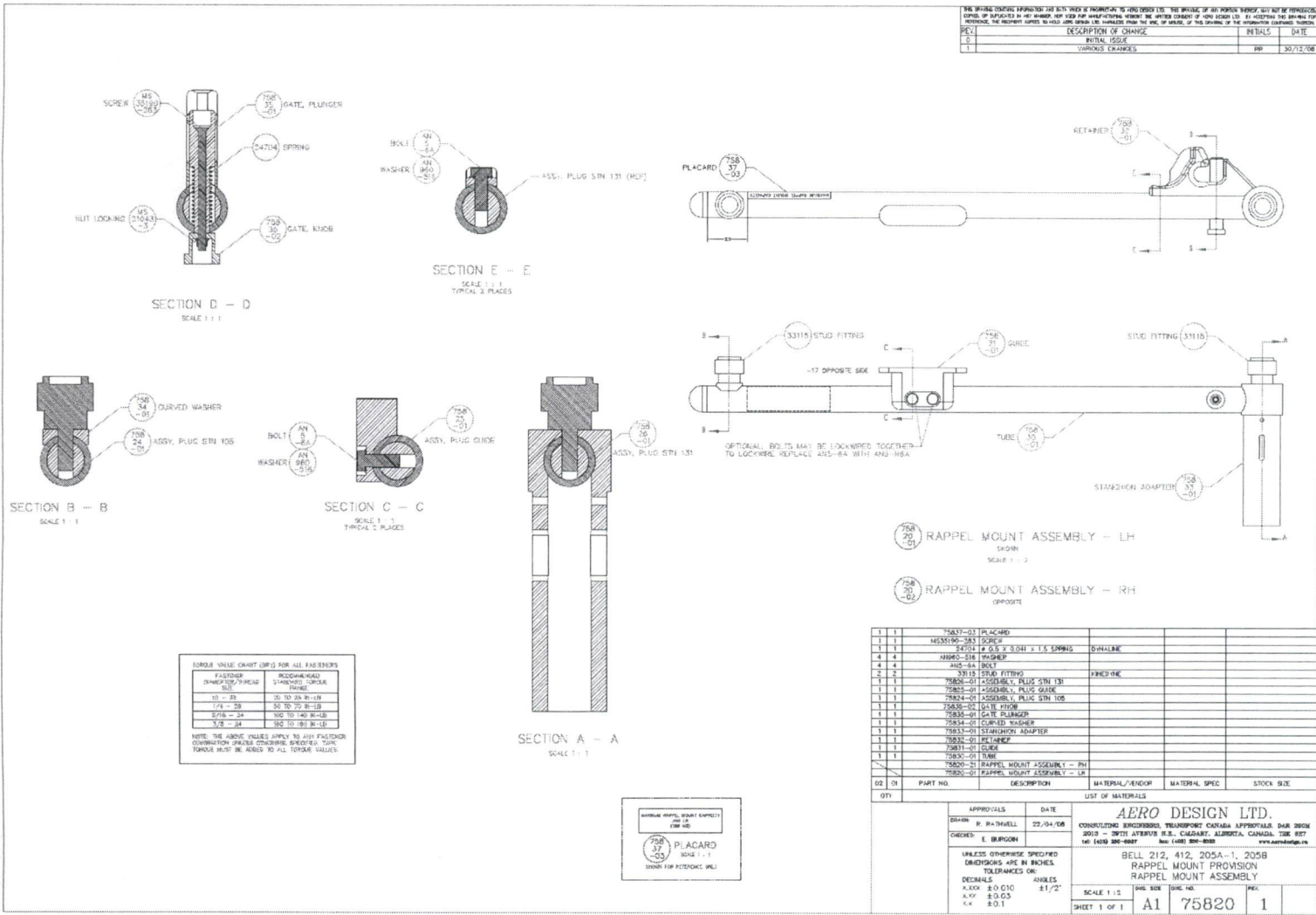
TORQUE VALUE CHART (DRY) FOR ALL FASTENERS

FASTENER DIAMETER/ THREAD SIZE	RECOMMENDED STANDARD TORQUE RANGE
10 - 32	20 to 25 in-lb
1/4 - 28	50 to 70 in-lb
5/16 - 24	100 to 140 in-lb
3/8 - 24	160 to 190 in-lb

NOTE: The above values apply to any fastener combination unless otherwise specified.
Tare torque must be added to all torque values.

APPENDIX A - REFERENCE DRAWINGS

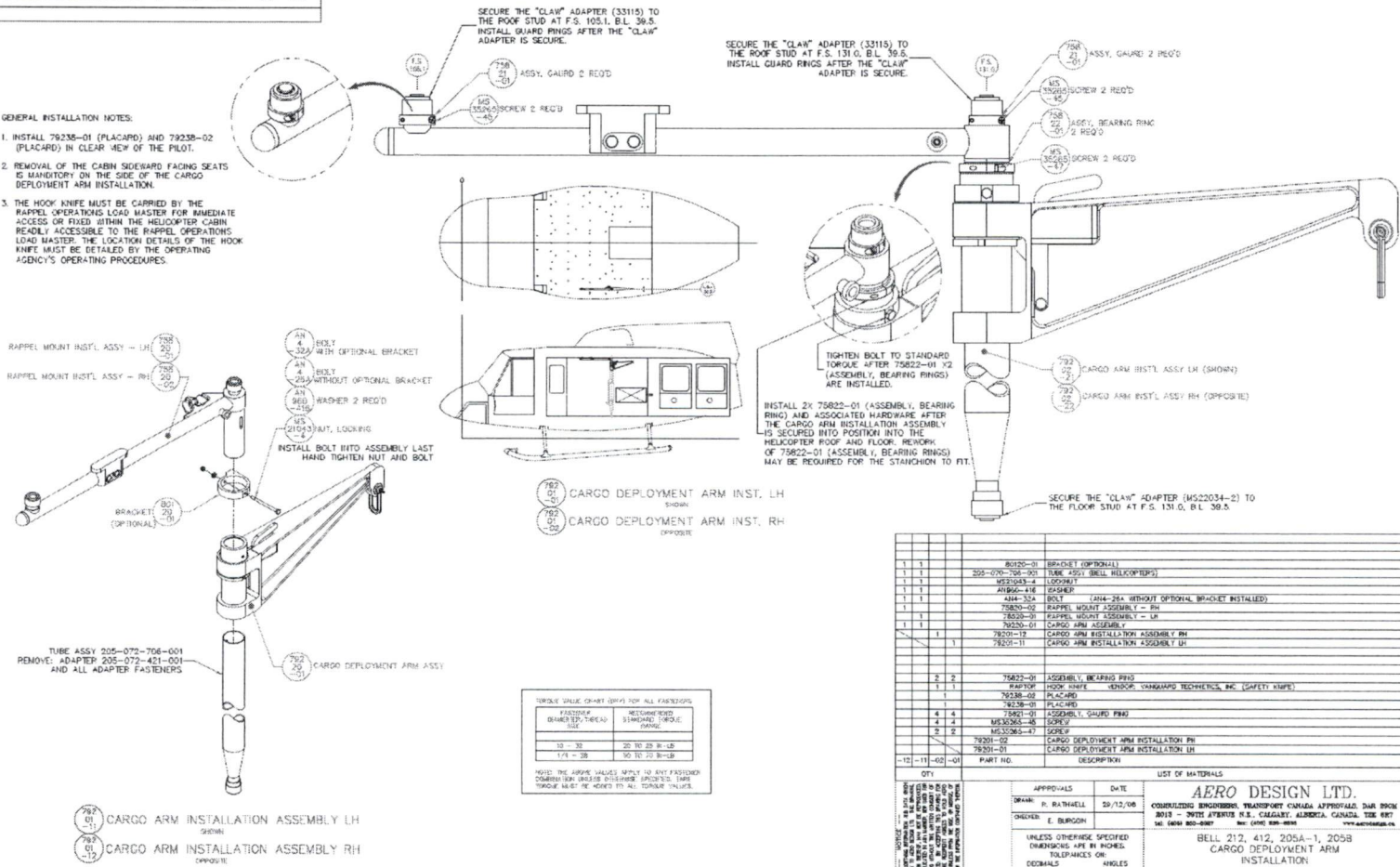
Drawing 75820 – Rappel Mount Provision Assembly



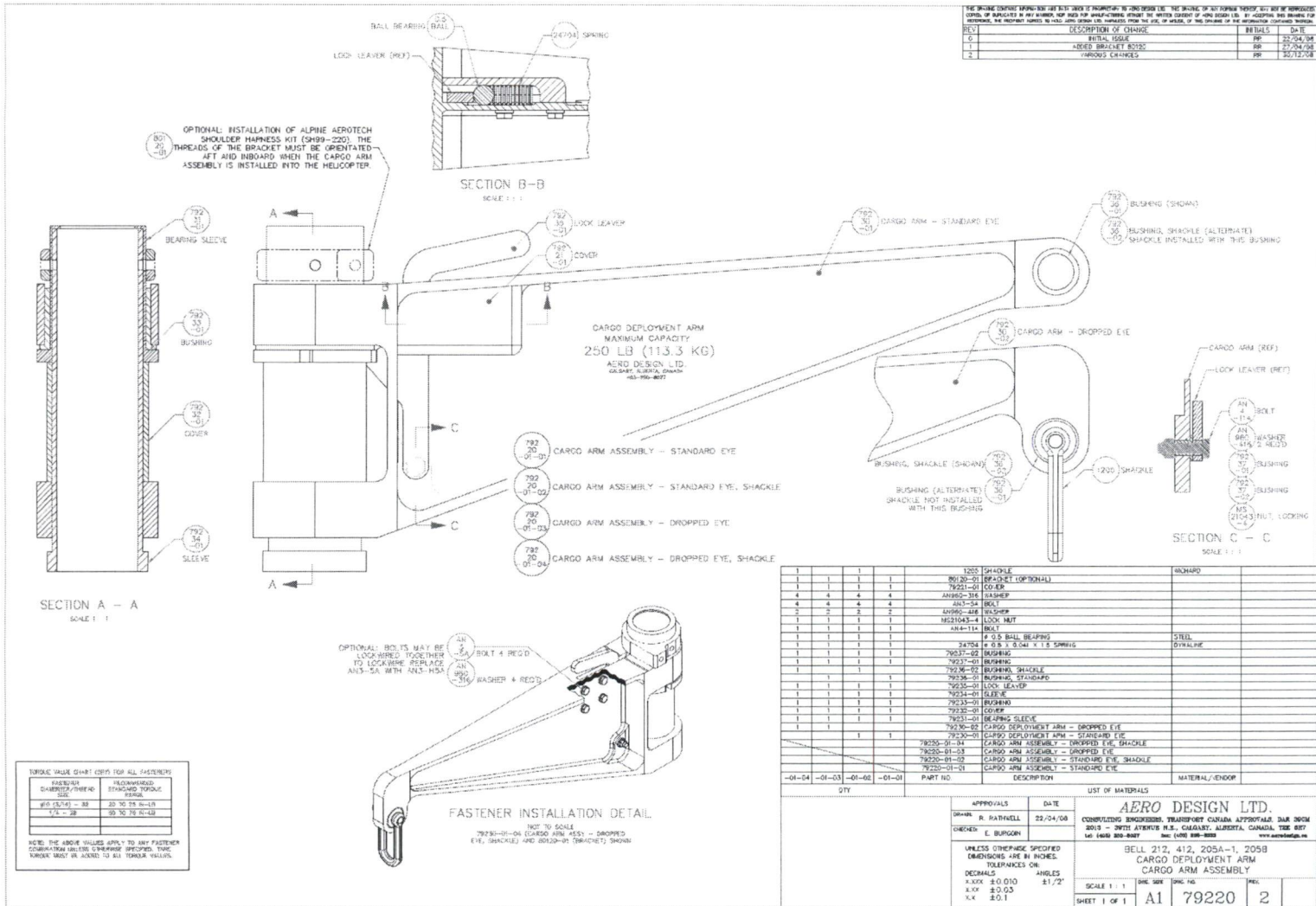
Drawing 79201 – Cargo Deployment Arm Installation

WEIGHT AND BALANCE						
ITEM	DESCRIPTION	WEIGHT (LB)	LONGITUDINAL		LATERAL	
			ARM (IN)	MOMENT (LB-IN)	ARM (IN)	MOMENT (LB-IN)
-01	CARGO DEPLOYMENT ARM INSTL LH	4.6	135.3	622.4	-34.5	-181.7
-02	CARGO DEPLOYMENT ARM INSTL RH	4.6	135.3	622.4	34.5	181.7

1. INSTALL 79235-01 (PLACAPAD) AND 79235-02 (PLACAPD) IN CLEAR VIEW OF THE PILOT.
2. REMOVAL OF THE CABIN SIDEWALL FACING SEATS IS MANDATORY ON THE SIDE OF THE CARGO DEPLOYMENT ARM INSTALLATION.
3. THE HOOK KNIFE MUST BE CARRIED BY THE RAPPEL OPERATIONS LOAD MASTER FOR IMMEDIATE ACCESS OR FIXED WITHIN THE HELICOPTER CABIN READILY ACCESSIBLE TO THE RAPPEL OPERATIONS LOAD MASTER. THE LOCATION DETAILS OF THE HOOK KNIFE MUST BE DETAILED BY THE OPERATING AGENCY'S OPERATING PROCEDURES.

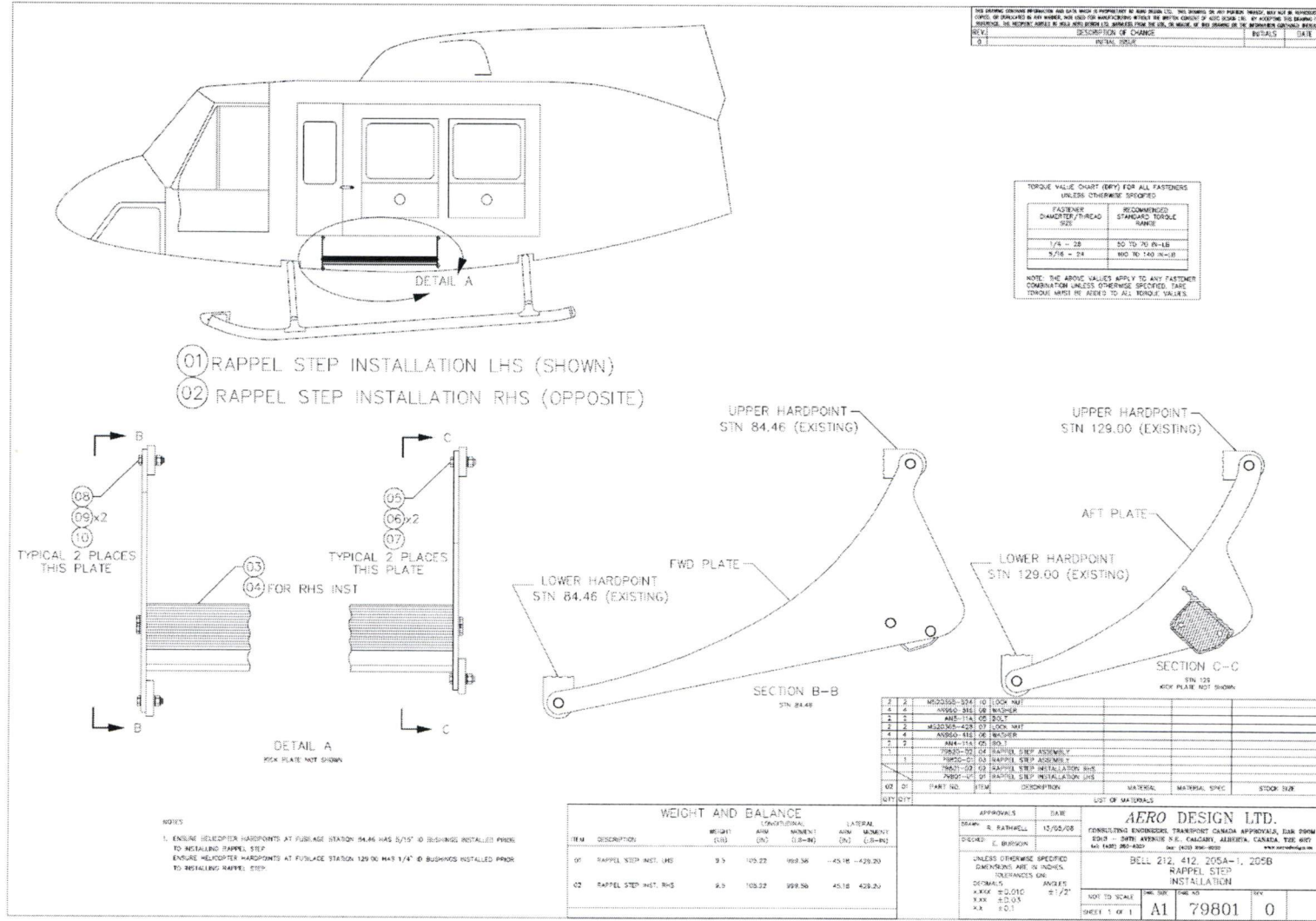


Drawing 79220 – Cargo Deployment Arm Assembly



Drawing 79801 - Rappel Step Installation

THIS IS NOT A CONTROLLED DOCUMENT AND IS FOR REFERENCE ONLY. REFER TO THE LATEST APPROVED ISSUE OF DRAWING 79801



THIS IS NOT A CONTROLLED DOCUMENT AND IS FOR REFERENCE ONLY. REFER TO THE LATEST APPROVED ISSUE OF DRAWING 79820



AERO DESIGN LTD.

FMS758.90

2013 – 39th Avenue NE
Calgary, Alberta, T2E 6R7

BELL 212, 412, 205A-1, 205B

ROTORCRAFT FLIGHT MANUAL SUPPLEMENT

for the

INSTALLATION of RAPPEL MOUNT PROVISION

Supplemental Type Certificate No. SH09-2

Sections 1, 2, 3 and 4 of this document comprise the Transport Canada Approved sections of this Flight Manual Supplement. Compliance with Section 1, Limitations, is mandatory.

Section 5 and any subsequent sections if present are Unapproved and are provided for information only.

The information and data contained in this Flight Manual Supplement supersede or supplement that contained in the basic Approved Flight Manual for the 212, 412, 205A-1 and 205B when fitted with the Rappel Mount Provision. For limitations, procedures and performance not listed in this Flight Manual Supplement, refer to the Approved Flight Manual and other approved Flight Manual Supplements.

Emailed to
Greg O. for
Approval.

AERO DESIGN LTD.

FMS758.90

Table of Contents

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5	Weight and Balance	10

1 LIMITATIONS

1-3 TYPES OF OPERATIONS:

The Rappel Mount Provision is an approved provision for rappel operations only.

Rappel operations permitted during VFR conditions only.

1-4 FLIGHT CREW:

Rappel Operations:

A second crewman is required as a Rappel Operations Load Master if rappel operations are to be conducted. The crewman must have full access of the cabin to perform duties as a Rappel Operations Load Master.

Rappellers may be present as passengers essential to the operation. The Rappellers must have full access of the passenger area within the cabin to perform duties as a Rappel Crew Member.

All Rappel Crew Members are to be directed by the Rappel Operations Load Master.

The Rappel Operations Load Master and all Rappel Crew Members must wear a protective helmet for moving about in the aircraft.

Carriage of Passengers during non-rappel flights:

All passengers must remain seated with the seatbelt fastened during flight.

1-5 CONFIGURATION:

The aircraft may be equipped with:

A Left Hand Rappel Mount Provision,

A Right Hand Rappel Mount Provision, or

Both Left Hand and Right Hand Rappel Mount Provisions.

1-5-A REQUIRED EQUIPMENT FOR RAPPEL OPERATIONS:

The aircraft must have a functioning communications system between the pilot and the load master.

A hook knife must be;

- i. Carried by the Rappel Operations Load Master for immediate access, or
- ii. Fixed within the helicopter interior, readily accessible to the Rappel Operations Load Master, as detail by the operating agency's operating procedures.

1-7 AIRSPEED

Rappel Operations: Hover with lateral translation at a speed not to exceed 10 knots is permitted for positioning only.

1-20 MARKINGS AND PLACARDS

Placards 75837-01 and 75837-02 to be in clear view of the pilot

**AIRCRAFT MUST BE IN HOVER
FOR RAPPEL OPERATIONS**

Placard 75837-01

**RAPPEL OPERATIONS DURING
VFR CONDITIONS ONLY**

Placard 75837-02

Placard 75837-03 to be attached to Rappel Mount Provision in clear view of the load master.

**MAXIMUM RAPPEL MOUNT CAPACITY
350 LBS
(158 KG)**

Placard 75837-03

2 NORMAL PROCEDURES

2-1 INTRODUCTION:

The Rappel Mount Provision is approved for rappel operations only. A rappel operation is the continuous controlled decent of a single person (the rappeller) from the aircraft to the ground. The rappeller descends on a rope fixed to the Rappel Mount Provision and controls the decent.

This section contains instructions for conducting rappel operations.

WARNING

STOPPING THE DECENT PRIOR TO REACHING THE GROUND EXPOSES THE RAPPELLER TO RISKS ASSOCIATED WITH RAPPELLING FROM HELICOPTERS. THE RAPPELLER SHOULD NOT STOP THE DECENT PRIOR TO REACHING THE GROUND UNLESS THE OPERATIONAL CONDITIONS CHANGE DURING THE DECENT AND REQUIRE THE RAPPELLER TO DO SO.

WARNING

IT IS NOT INTENDED THAT THE RAPPEL MOUNT PROVISION BE USED FOR EXTRACTING PERSONNEL.

AERO DESIGN LTD.

FMS758.90

2-3 PREFLIGHT CHECK:

Visually inspect the Rappel Mount Provision for loose fasteners and wear.

Ensure the roof and floor fittings are properly in position and locked.

2-9

IN FLIGHT OPERATIONS - RAPPEL OPERATIONS:

Ensure communication between the pilot and the load master is established and maintained.

WARNING

**STOP RAPPEL OPERATIONS IF
COMMUNICATION BETWEEN THE PILOT
AND THE LOAD MASTER HAS FAILED**

Rappel operations may commence only on the pilot's command

Rappel operations must stop on the pilot's command.

The aircraft must be in hover flight during rappel operations

The aircraft must maintain an altitude that ensures the rappel line is in contact with the ground.

The rappel rope must be dropped to the ground when the rappel operation is complete. Do not retract the rappel line into the aircraft.

The load master must observe the rappel operation and communicate to the pilot the status of the rappel operation continuously.

3 EMERGENCY PROCEDURES

Suspension line jettisonability lies within the direct control of the load master under the pilots command. Clear communication between the pilot and the load master must be maintained during rappel operations.

SUSPENSION LINE JETTISON PROCEDURE

On the command of the pilot the load master must jettison the suspension line by:

- i. Releasing the suspension line, or
- ii. Cutting the line with the hook knife provided for the Rappel Operations Load Master.

WARNING

**THE SUSPENSION LINE MUST BE CUT
AS SHORT AS PRACTICAL.**

**ANY LOOSE LINE REMAINING MUST BE
IMMEDIATELY SECURED TO PREVENT
ANY POSSIBLE ENTANGLEMENT WITH
THE HELICOPTER ROTOR SYSTEM.**

4 PERFORMANCE

No change from basic Rotorcraft Flight Manual.

5 WEIGHT AND BALANCE

English Units		Longitudinal		Lateral	
Item	Weight (Lb)	Arm (in)	Moment (in*Lb)	Arm (in)	Moment (in*Lb)
Left Hand Rappel Mount Provision 75801-01	7.63	120.4	918.6	-39.5	-301.4
Right Hand Rappel Mount Provision 75801-02	7.63	120.4	918.6	39.5	301.4

Metric Units		Longitudinal		Lateral	
Item	Weight (kg)	Arm (m)	Moment (kg*m)	Arm (m)	Moment (kg*m)
Left Hand Rappel Mount Provision 75801-01	3.5	3.06	10.71	-1.00	-3.5
Right Hand Rappel Mount Provision 75801-02	3.5	3.06	10.71	1.00	3.5

Note: 1. A rappeller suspended from the Rappel Mount Provision is located at Fuselage Station 113in and Right Butt Line 50in (for Right Hand Rappel Mount Provision) and/or Left Butt Line -50in (for Left Hand Rappel Mount Provision).

2. The weight and balance values above are to be used if the Rappel Mount is installed in accordance with Drawing 75801. If the Rappel Mount is installed with a Cargo Arm in accordance with Drawing 79201, then the above weight and balance values are superseded by the weight and balance values found in RFMS792.90.

AERO DESIGN LTD.

FMS792.90

2013 – 39th Avenue NE
Calgary, Alberta, T2E 6R7

BELL 212, 412, 205A-1, 205B

ROTORCRAFT FLIGHT MANUAL SUPPLEMENT

for the

INSTALLATION of the CARGO DEPLOYMENT ARM

Supplemental Type Certificate No. SH09-2

Sections 1, 2, 3 and 4 of this document comprise the Transport Canada Approved sections of this Flight Manual Supplement. Compliance with Section 1, Limitations, is mandatory.

Section 5 and any subsequent sections if present are Unapproved and are provided for information only.

The information and data contained in this Flight Manual Supplement supersede or supplement that contained in the basic Approved Flight Manual for the 212, 412, 205A-1 and 205B when fitted with the Cargo Deployment Arm. For limitations, procedures and performance not listed in this Flight Manual Supplement, refer to the Approved Flight Manual and other approved Flight Manual Supplements.

Emailed to Greg O.
for Approval.

AERO DESIGN LTD.

FMS792.90

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1 LIMITATIONS

1-3 TYPES OF OPERATIONS:

The Cargo Deployment Arm is an approved provision for non-human, cargo deployment only.

Cargo Deployment operations permitted during VFR conditions only.

1-4 FLIGHT CREW:

Cargo Deployment Operations:

A second crewman to operate the cargo deployment arm is required if cargo deployment operations are to be conducted. The crewman must have full access of the cabin to perform duties as a Cargo Deployment Operations Load Master.

All cargo deployment crew members must wear a protective helmet for moving about in the aircraft.

Carriage of Passengers during non-cargo deployment flights:

All passengers must remain seated with the seatbelt fastened during flight.

1-5 CONFIGURATION:

The aircraft may be equipped with:

A Left Hand Cargo Deployment Arm,

A Right Hand Cargo Deployment Arm, or

Both Left Hand and Right Hand Cargo Deployment Arm.

The sideward facing seats on the left hand side must be removed if the Cargo Deployment Arm is installed on the left hand side of the helicopter.

The sideward facing seats on the right hand side must be removed if the Cargo Deployment Arm is installed on the right hand side of the helicopter.

1-5-A REQUIRED EQUIPMENT FOR CARGO DEPLOYMENT OPERATIONS:

The aircraft must have a functioning communications system between the pilot and the load master.

A hook knife must be;

- i. Carried by the Cargo Deployment Operations Load Master for immediate access, or
- ii. Fixed within the helicopter interior, readily accessible to the Cargo Deployment Operations Load Master, as detail by the operating agency's operating procedures.

1-7 AIRSPEED

Cargo Deployment Operations: Hover with lateral translation at a speed not to exceed 10 knots is permitted for positioning only.

1-20 MARKINGS AND PLACARDS

Placards 79228-01 and 79228-02 to be in clear view of the pilot

**AIRCRAFT MUST BE IN HOVER FOR
CARGO DEPLOYMENT OPERATIONS**

Placard 79228-01

**CARGO DEPLOYMENT OPERATIONS
DURING VFR CONDITIONS ONLY**

Placard 79228-02

The following placard is engraved onto both sides of the Cargo
Deployment Arm.

**MAXIMUM CARGO DEPLOYMENT ARM
CAPACITY
250 LB (113.3 KG)**

2 NORMAL PROCEDURES

2-1 INTRODUCTION:

The Cargo Deployment Arm is approved for non-human cargo deployment operations only. A cargo deployment operation is the continuous controlled decent of cargo from the aircraft to the ground. The cargo is fixed to a suspension line. The suspension line passes through a decent control device, such as a sky-genie or figure-of-eight. The decent of the cargo is controlled by the load master holding the "loose-end" of the suspension line within the cabin of the helicopter.

This section contains instructions for conducting cargo deployment operations.

WARNING

THE CARGO DEPLOYMENT LOAD MASTER SHOULD NOT STOP THE DECENT OF CARGO PRIOR TO REACHING THE GROUND UNLESS THE OPERATIONAL CONDITIONS CHANGE DURING THE DECENT AND REQUIRE THE LOAD MASTER TO DO SO.

WARNING

USING THE CARGO DEPLOYMENT ARM FOR EXTRACTIONS IS NOT PERMITTED.

WARNING

USING THE CARGO DEPLOYMENT ARM FOR HUMAN EXTERNAL CARGO OPERATIONS IS NOT PERMITTED.

2-3 PREFLIGHT CHECK:

Visually inspect the Cargo Deployment Arm for loose fasteners and wear.

Ensure the roof and floor fittings are properly in position and locked.

2-9 IN FLIGHT OPERATIONS – CARGO DEPLOYMENT OPERATIONS:

Ensure communication between the pilot and the load master is established and maintained.

WARNING

**STOP CARGO DEPLOYMENT
OPERATIONS IF COMMUNICATION
BETWEEN THE PILOT AND THE LOAD
MASTER HAS FAILED**

Cargo deployment operations may commence only on the pilot's command

Cargo deployment operations must stop on the pilot's command.

The aircraft must be in hover flight during cargo deployment operations

The cargo deployment line must be dropped to the ground when the cargo deployment operation is complete. Do not retract the cargo deployment line into the aircraft.

The load master must observe the cargo deployment operation and communicate to the pilot the status of the cargo deployment operation continuously.

3 EMERGENCY PROCEDURES

Suspension line jettisonability lies within the direct control of the load master under the pilots command. Clear communication between the pilot and the load master must be maintained during cargo deployment operations.

SUSPENSION LINE JETTISON PROCEDURE

On the command of the pilot the load master must jettison the suspension line by:

- i. Releasing the suspension line, or
- ii. Cutting the line with the hook knife provided for the Cargo Deployment Load Master.

WARNING

**THE SUSPENSION LINE MUST BE CUT
AS SHORT AS PRACTICAL.**

**ANY LOOSE LINE REMAINING MUST BE
IMMEDIATELY SECURED TO PREVENT
ANY POSSIBLE ENTANGLEMENT WITH
THE HELICOPTER ROTOR SYSTEM.**

4 PERFORMANCE

No change from basic Rotorcraft Flight Manual.

5 WEIGHT AND BALANCE

English Units		Longitudinal		Lateral	
Item	Weight (Lb)	Arm (in)	Moment (in*Lb)	Arm (in)	Moment (in*Lb)
Left Hand Cargo Deployment Arm 79201-01	12.23	126.0	1541.0	-39.5	-483.1
Right Hand Cargo Deployment Arm 79201-02	12.23	126.0	1541.0	39.5	483.1

Metric Units		Longitudinal		Lateral	
Item	Weight (kg)	Arm (m)	Moment (kg*m)	Arm (m)	Moment (kg*m)
Left Hand Cargo Deployment Arm 79201-01	5.5	3.2	17.6	-1.0	-5.5
Right Hand Cargo Deployment Arm 79201-02	5.5	3.2	17.6	1.0	5.5

Note: 1. Cargo suspended from the Cargo Deployment Arm is located at Fuselage Station 131in and Right Butt Line 57.5in (for Right Hand Cargo Deployment Arm) and/or Left Butt Line -57.5in (for Left Hand Cargo Deployment Arm).

2. The above weight and balance values supersede the weight and balance values in RFMS758.90.

AERO Design Ltd.

**ENGINEERING REPORT
ER801.01**

Shoulder Harness Bracket

Bell 412, 212, 205A-1, 205B

- Reworked For 6061-T6 Bar $F_{tu}(L) = 38 \text{ ksi}$

$\rightarrow F_{tu}(LT) = 37 \text{ ksi}$

Approved by: E. Burgoin, P. Eng.

$F_{tu}(LT)$ used for Rework

Prepared by: Richard Rathwell

and

$F_{su} = 26 \text{ ksi}$

Revision 0

Date: 14 May, 2008

AERO Design Ltd.
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X — Result Summary of Rework — X
All MS + (ive)
RR.

Revision 0

14 May 2008
Page 1

Ref
only
see ~~Mr~~ ERECOB01

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1.0 INTRODUCTION

This document will show elements the installation of the Shoulder Harness Bracket p/n 80120 is in compliance with Federal Aviation Regulations

This installation replaces the stanchion post collar assembly of the Alpine Aerotech Ltd. Shoulder Harness Kit on the seat post stanchion with a bracket that will interface with the Aero Design Ltd. Cargo Deployment Arm.

2.0 REFERENCE

AERO Design Ltd. Drawing 79220 Cargo Arm Assembly

AERO Design Ltd. Drawing 80120 Bracket Assembly

AERO Design Ltd. Document ER758.01

FAR 29.561 Emergency Landing Conditions

FAR 29.785(f) Seats, Safety Belts, and Harnesses

AC 29-2B Certification of Transport Category Rotorcraft

3.0 BASIS OF CERTIFICATION

Bell 412: FAR Part 29 dated 1 February 1965, Amendment 29-1 and 29-2

Bell 212: FAR Part 29 dated 1 February 1965, Amendment 29-1 and 29-2

Bell 205A-1: CAR 7 dated August 1, 1956, Amendments 7-1 through 7-4

Bell 205B: CAR 7 dated August 1, 1956, Amendments 7-1 through 7-4

This installation: FAR Part 29 dated 1 February 1965, Amendment 29-1 and 29-2 and Amendment 29-43 for 29.865(a) and 29.865(e)

4.0 ANALYSIS OF CURRENT AIRWORTHINESS DIRECTIVES (AD'S)

There are no current AD's related to this installation. Refer to Aero Design Ltd. Document ER758.01 for details.

5.0 STRUCTURAL ANALYSIS – SHOULDER HARNESS BRACKET

5.1 Loads and Factors

Factors

Inertia Forces (Ultimate) per 29.561

Upward	$n_{ult_up} := 1.5$
Forward	$n_{ult_fwd} := 4.0$
Sideward	$n_{ult_side} := 2.0$
Downward	$n_{ult_down} := 4.0$

Shoulder Harness Attachment
Multiplication Factor

Per 29.785

$$n_{mf} := 1.33$$

Loads

AC 29-2B para 335A b. (3) states;

(3) Shoulder harnesses need only be substantiated for 40 percent of total occupant load rather than the former 60 percent adopted by Amendment 29-24.

This analysis will conservatively substantiate for 60% of the occupant's load, therefore the applicable loads for analysis are;

Weight of Occupant per 29.785

$$wt_{occ} := 170 \text{ lbf}$$

Upward	$P_{ult_up} := n_{ult_up} \cdot n_{mf} \cdot wt_{occ} \cdot .6$	$P_{ult_up} = 203.49 \text{ lbf}$
Forward	$P_{ult_fwd} := n_{ult_fwd} \cdot n_{mf} \cdot wt_{occ} \cdot .6$	$P_{ult_fwd} = 542.64 \text{ lbf}$
Sideward	$P_{ult_side} := n_{ult_side} \cdot n_{mf} \cdot wt_{occ} \cdot .6$	$P_{ult_side} = 271.32 \text{ lbf}$
Downward	$P_{ult_down} := n_{ult_down} \cdot n_{mf} \cdot wt_{occ} \cdot .6$	$P_{ult_down} = 542.64 \text{ lbf}$

5.2 Analysis

AN4 Bolt Attaching Harness to Bracket

Properties - AN4 Bolt

Tension

$$F_{tu_AN4} := 4170 \cdot \text{lbf}$$

Single Shear

$$F_{su_AN4} := 3680 \cdot \text{lbf}$$

Reaction - Downward Load

$$MS_{\text{down_AN4_harness}} := \frac{F_{su_AN4}}{P_{ult_down}} - 1$$

$$MS_{\text{down_AN4_harness}} = 5.782$$

MARGIN OF SAFETY IS POSITIVE

Reaction - Forward Load

This load and the bolt strength allowable is identical to the downward load case, therefore:

MARGIN OF SAFETY IS POSITIVE

Reaction - Upward Load

This load is less than the downward and forward load cases, while the bolt strength allowable remains the same, therefore:

MARGIN OF SAFETY IS POSITIVE

Reaction - Sideward Load

$$MS_{\text{side_AN4_harness}} := \frac{F_{tu_AN4}}{P_{ult_side}} - 1$$

$$MS_{\text{side_AN4_harness}} = 14.369$$

MARGIN OF SAFETY IS POSITIVE

Analysis - Bracket Threads in Shear - Engaged with Helicoil

Assumption: Thread Engagement is 1.0 x Bolt Dia., 1/4 inch dia (assumed smaller than actual and therefore this analysis shall conservatively work with less shear area).

Mechanical Properties of Thread Engagement:

$$D_{AN4} := 0.25 \text{ in}$$

$$L_{\text{engage}} := D_{AN4} \cdot 1.0$$

$$L_{\text{engage}} = 0.25 \text{ in}$$

Pitch Diameter:

$$D_{p_25} := 0.227 \text{ in}$$

$$A_{s_25} := \pi \cdot D_{p_25} \cdot L_{\text{engage}} \cdot 0.5$$

$$A_{s_25} = 0.089 \text{ in}^2$$

$$\tau_{\text{thread_25}} := \frac{P_{\text{ult_side}}}{A_{s_25}}$$

$$\tau_{\text{thread_25}} = 3043.7 \text{ psi}$$

Mechanical Properties of ~~6061-T651~~

Per MMPDS-01

Shear

$$F_{su_6061} := \cancel{27 \text{ ksi}} \quad 26 \text{ ksi}$$

Margin of Safety:

$$MS_{\text{thread_25}} := \left(\frac{F_{su_6061}}{\tau_{\text{thread_25}}} \right) - 1$$

$$MS_{\text{thread_25}} = \cancel{7.9}$$

7.5

MARGIN OF SAFETY IS POSITIVE

OK

Analysis of the Stanchion Bolt (AN4)

Forward Load (See FIGURE 5.2.1)

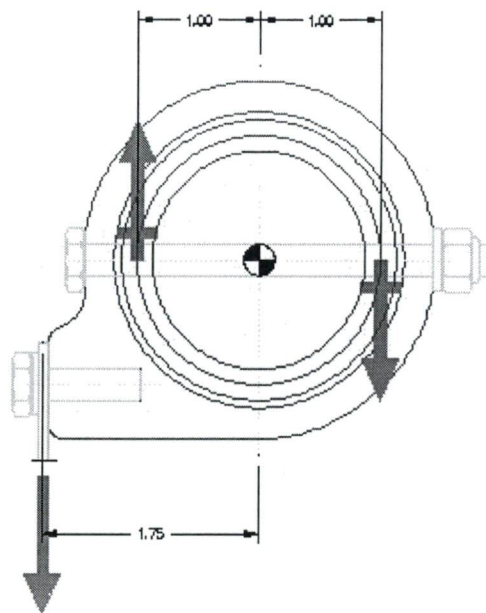


FIGURE 5.2.1

Eccentric Load Analysis of Stanchion Bolt

Distance of the load from the centroid (center of stanchion)

$$D_{\text{cent_load}} := 1.75 \cdot \text{in}$$

Distance of the bolt shear plane to the centroid (2 places - equal)

$$D_{\text{cent_shear}} := 1.00 \cdot \text{in}$$

Stress

$$\tau_{\text{fwd_AN4_stan}} := \frac{P_{\text{ult_fwd}} \cdot D_{\text{cent_load}}}{2 \cdot D_{\text{cent_shear}}}$$

$$\tau_{\text{fwd_AN4_stan}} = 474.81 \text{ lbf}$$

Margin of Safety

$$MS_{\text{fwd_AN4_stan}} := \frac{F_{\text{su_AN4}}}{\tau_{\text{fwd_AN4_stan}}} - 1$$

$$MS_{\text{fwd_AN4_stan}} = 6.75$$

MARGIN OF SAFETY IS POSITIVE

Sideward Load

This load case is somewhat similar to the forward load case in the manner for which the load is reacted, however the sideward load acts closer to the centroid of the bracket installation. Therefore the critical load case is the forward load case, detailed above.

Downward and Upward Load

These load cases place the AN4 Bolt in double shear - The downward load case is critical. The AN4 Bracket bolt has been analyzed in single shear above (see AN4 Bolt attaching Harness to Bracket Analysis) and the margin of safety was positive.

Analysis of the Bracket

Forward Load (See FIGURE 5.2.2)

Eccentric Load Analysis of Bracket - Reaction at "B" and "D" - Reactions are equal, but opposite.

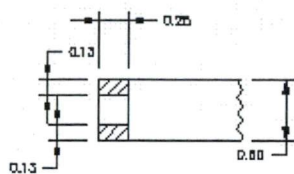
$$\tau_{\text{fwd_ecc}} := \frac{P_{\text{ult_fwd}} \cdot 1.75 \cdot \text{in}}{2 \cdot 1.19 \cdot \text{in}}$$

$$\tau_{\text{fwd_ecc}} = 399 \text{ lbf}$$

Reactions at "B" and "D" due to forward load.

$$\tau_{\text{fwd_fwd}} := \frac{P_{\text{ult_fwd}}}{2}$$

$$\tau_{\text{fwd_fwd}} = 271.32 \text{ lbf}$$



SECTION A-A

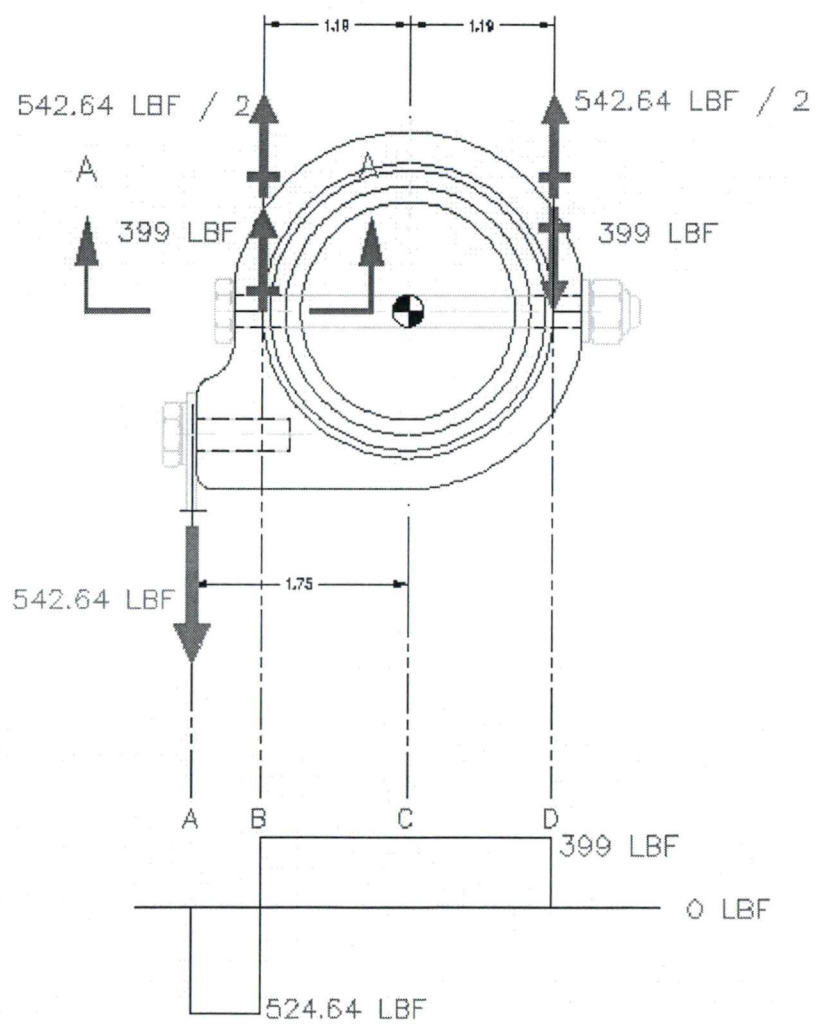


FIGURE 5.2.2

Resolved Reactions at "B" and "D"

$$R_B := \tau_{fwd_ecc} + \tau_{fwd_fwd}$$

CRITICAL

$$R_B = 670.321bf$$

$$R_D := -\tau_{fwd_ecc} + \tau_{fwd_fwd}$$

$$R_D = -127.681bf$$

Section Area and "B"

$$A_B := 0.125 \cdot in^2$$

Mechanical Properties 6061-T651

Tension

6061-T6

$$F_{tu_6061} := 42ksi$$

37ksi

Stress

$$\sigma_B := \frac{R_B}{A_B}$$

$$\sigma_B = 5362.6psi$$

Margin of Safety

$$MS_{fwd_bracket_B} := \frac{F_{tu_6061}}{\sigma_B} - 1$$

$$MS_{fwd_bracket_B} = 6.8$$

5.9

MARGIN OF SAFETY IS POSITIVE

OK

Sideward Load

This load case is somewhat similar to the forward load case in the manner for which the load is reacted, however the sideward load acts closer to the centroid of the bracket installation. Therefore the critical load case is the forward load case, detailed above.

AERO Design Ltd.

**ENGINEERING REPORT
ER808.01**

**Rappel Mount Provision
Cargo Deployment Arm
Rappel Step**

Bell 412, 212, 205A-1, 205B

Approved by: E. Burgoin, P. Eng.

Prepared by: Richard Rathwell

Revision 0

Date: 30 December 2008

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1.0 INTRODUCTION

The Rappel Mount Provision, the Cargo Deployment Arm and the Rappel Step of this Supplemental Type Certificate (STC) approval is based on Limited Supplemental Type Certificate (LSTC) C-LSH08-157/D Issue 1. The parts, assemblies and installations covered under approval C-LSH08-157/D were found acceptable with the following documents:

1. AERO Design Ltd. Document ER758.01 Engineering Report,
2. AERO Design Ltd. Document ER801.01 Engineering Report, and
3. AERO Design Ltd. Document TP792.02 Test Plan/Report (Flight).

Many of the parts, assemblies and installations covered by the above listed documents have been revised for the STC approval. Also, some new parts have been added for the STC approval. This report shall act as a bridge to show that the revised and new elements of the installations for the Rappel Mounting Provision, the Cargo Deployment Arm and the Rappel Step are in compliance with Federal Aviation Regulations. The specific regulations are detailed in the Aero Design Ltd. Document CP758-1 Rev 1, *Compliance Program* and Aero Design Ltd. Document CP758-2 Rev 2, *Compliance Program* and Aero Design Ltd. Document CP798 Rev 0, *Compliance Program*.

2.0 REFERENCE

AERO Design Ltd. Drawing 75801 Rappel Mount Provision
AERO Design Ltd. Drawing 79201 Cargo Deployment Arm
AERO Design Ltd. Drawing 79801 Rappel Step
AERO Design Ltd. Document CP758-01 *Compliance Program*
AERO Design Ltd. Document CP758-02 *Compliance Program*
AERO Design Ltd. Document CP798 *Compliance Program*
AERO Design Ltd. Document ER758.01 *Engineering Report*
AERO Design Ltd. Document ER801.01 *Engineering Report*
AERO Design Ltd. Document ER758.02 *Test Plan/Report (Flight)*
Analysis and Design of Flight Vehicle Structures, Bruhn

3.0 BASIS OF CERTIFICATION

Bell 412: FAR Part 29 dated 1 February 1965, Amendment 29-1 and 29-2

Bell 212: FAR Part 29 dated 1 February 1965, Amendment 29-1 and 29-2

Bell 205A-1: CAR 7 dated August 1, 1956, Amendments 7-1 through 7-4

Bell 205B: CAR 7 dated August 1, 1956, Amendments 7-1 through 7-4

This installation: FAR Part 29 dated 1 February 1965, Amendment 29-1 and 29-2 and Amendment 29-43 for 29.865(a) and 29.865(e)

4.0 SUMMARY OF CHANGES

4.1 Rappel Mount Provision Changes

Part/Ass'y Number	Description	Change?		Description of Change(s)	Engineering Consideration (Structural)
		Yes	No		
75801-01	Rappel Mount Provision Inst'l LH	X		Various	Bearing clips replaced by bearing ring. See 75822-01 for engineering consideration. No other relevant part configuration change.
75801-02	Rappel Mount Provision Inst'l RH	X		Various (opposite 75801-01)	N/A (see 75801-01)
75801-11	Rappel Mount Inst'l Ass'y LH		New		Installation sub assembly. Engineering consideration made at the installation level.
75801-12	Rappel Mount Inst'l Ass'y RH		New		N/A (see 75801-11)
75820-01	Rappel Mount Ass'y LH	X		No part configuration change	N/A
75820-02	Rappel Mount Ass'y RH	X		No part configuration change	N/A
75821-01	Assembly, Guard Ring		NEW		This part prevents the roof stud fitting from coming undone as an added safety measure. This part bears no load. This part is acceptable.
75822-01	Assembly, Bearing Ring		NEW		This part replaces the bearing Clips (p/n 75856-01). The relevant material properties (Fbru) of the new and replaced part are similar. The new part is much larger and has more bearing area than the replaced part. The new part performs the same function as the replaced part. Therefore: The new part is a acceptable replacement.
75824-01	Assembly, Plug, STN 105	X *		No change to geometry	N/A
75825-01	Assembly, Plug Guide	X *		Material added	The material added is to aid disassembly is not relevant to the operation of the part. This part is acceptable.
75826-01	Assembly, Plug, STN 131	X *		Part modified to fit LH and RH Rappel Mount Ass'y	The modification is allow the part to fit the LH and RH Rappel Mount Ass'y. The modification does not change the relevant structure of the part. This part is acceptable.
75830-01	Tube	X *		Part modified to fit LH and RH Rappel Mount Ass'y	The modification is allow the part to fit the LH and RH Rappel Mount Ass'y. The modification does not change the relevant structure of the part. This part is acceptable.

* A finish specification has been added to the part. No other structural change had been made unless noted.

Part/Ass'y Number	Description	Change?		Description of Change(s)	Engineering Consideration (Structural)
		Yes	No		
75831-01	Retainer	X *		Material added to part	The material added to the part adds the parts strength. This part is acceptable.
75832-01	Guide	X *		Part modified to fit LH and RH Rappel Mount Ass'y	The modification is allow the part to fit the LH and RH Rappel Mount Ass'y. The modification does not change the relevant structure of the part. This part is acceptable.
75833-01	Stanchion Adapter	X *		No change to geometry	N/A
75834-01	Curved Washer	X *		Material added to part	The material added to the part adds the parts strength. This part is acceptable.
75835-01	Gate Plunger	X		Part geometry changed	This part bears no load. This part is acceptable.
75835-02	Gate Knob	X		Part geometry changed	This part bears no load. This part is acceptable.
75837-01	Placard		NEW		N/A Non-structural part
75837-02	Placard		NEW		N/A Non-structural part
75837-03	Placard		NEW		N/A Non-structural part

* A finish specification has been added to the part. No other structural change had been made unless noted.

4.2 Cargo Deployment Arm Changes

Part/Ass'y Number	Description	Change?		Description of Change(s)	Engineering Consideration (Structural)
		Yes	No		
79201-01	Cargo Deployment Arm Inst'l LH	X		Various	Bearing clips replaced by bearing ring. See 75822-01 for engineering consideration. No other relevant part configuration change.
79201-02	Cargo Deployment Arm Inst'l RH	X		Various (opposite 79201-01)	N/A (see 79201-01)
79201-11	Cargo Arm Inst'l Ass'y LH		NEW		Installation sub assembly. Engineering consideration made at the installation level.
79201-12	Cargo Arm Inst'l Ass'y RH		NEW		N/A (see 79201-11)
79220-01-01	Cargo Deployment Arm Ass'y Std Eye		NEW		This new assembly replaces 79220-01. The new assembly changes the spring mechanism for the lock lever and reduces the material in the cargo arm (79230-01). The spring mechanism bears no load. See engineering consideration for cargo arm 79230-01.
79220-01-02	Cargo Deployment Arm Ass'y Std Eye - Shackle		NEW		Same as 79220-01-01 with exception: Adds shackle as cargo rigging attachment location. See engineering consideration for Shackle 1205 and Bushing 79236-02.
79220-01-03	Cargo Deployment Arm Ass'y Dropped Eye		NEW		This new assembly replaces 79220-01. The new assembly changes the spring mechanism for the lock lever, reduces the material, and drops the eye of the cargo arm (79230-02). The spring mechanism bears no load. See engineering consideration for cargo arm 79230-02.
79220-01-04	Cargo Deployment Arm Ass'y Dropped Eye - Shackle		NEW		Same as 79220-01-03 with exception: Adds shackle as cargo rigging attachment location. See engineering consideration for Shackle 1205 and Bushing 79236-02.
1205	Shackle (Wichard)		NEW		The ultimate load for the shackle to carry is 1125lbf. The breaking load for this part is 5950lbf. The breaking load for the shackle is greater than five times the ultimate load ((5950lbf / 1125lbf) - 1 = MS 4.3). This part is acceptable.
79221-01	Cover		NEW		This part contains the spring mechanism for locking and unlocking the cargo arm. This part bears no load during cargo deployment operations. This part is acceptable.
79230-01	Cargo Arm Standard Eye	X *		Various	This structural changes to this part are addressed in Section 5.

* A finish specification has been added to the part. No other structural change had been made unless noted.

Part/Ass'y Number	Description	Change?		Description of Change(s)	Engineering Consideration (Structural)
		Yes	No		
79230-02	Cargo Arm Dropped Eye	NEW			This part is a new alternate cargo arm provided as an optional to the standard cargo arm (79230-01). The structure has been analyzed in Section 5.
79231-01	Bearing Sleeve			Part modified to fit LH and RH Rappel Mount Ass'y	The modification is allow the part to fit the LH and RH Rappel Mount Ass'y. The modification does not change the relevant structure of the part. This part is acceptable.
79232-01	Cover	X *		No change to geometry	N/A
79233-01	Bushing		X	No change	N/A
79234-01	Sleeve		X	No change	N/A
79235-01	Lock Leaver	X		Geometry change to suit new spring mechanism	Change does not affect structure. This part is acceptable.
79236-01	Bushing, Carabiner	X		Defined fit tolerance	Change does not affect structure. This part is acceptable.
79236-02	Bushing, Shackle	NEW			This part is of the same material and similar function of bushing 79236-01 and is provided as an option. This new part contains more material than the part it replaces. This part is acceptable.
79237-01	Bushing	X		Defined fit tolerance	Change does not affect structure. This part is acceptable.
79237-02	Bushing	X		Defined fit tolerance	Change does not affect structure. This part is acceptable.
80120-01	Bracket	X *		Material Change	This structural changes to this part are addressed in Section 6.
79238-01	Placard	NEW			N/A Non-structural part
79238-02	Placard	NEW			N/A Non-structural part

* A finish specification has been added to the part. No other structural change had been made unless noted.

4.3 Rappel Step Changes

The finish specification definition is the only change applied to the Rappel Step components.

5.0 STRUCTURAL ANALYSIS OF ELEMENT CHANGES – CARGO DEPLOYMENT ARM

5.1 Loads and Factors (review from ER758.01)

Weight of Cargo: Maximum weight of Cargo per FMS Limitation $W_{car} := 250 \text{ lbf}$

External Load Factor: Per AERO Design Ltd.
Note: this load factor exceeds FAR
29.865 of 2.5 $n_{AD} := 3.0$

Safety Factor: Per 29.303 $n_{sf} := 1.5$

Fitting Factor: Per 29.625 $n_{ff} := 1.15$

Limit Downward Load Factor:

$$n_{v_lim} := n_{AD} \cdot n_{ff} \quad n_{v_lim} = 3.45$$

Limit Downward Load of Suspended Cargo:

$$P_{car_lim} := W_{car} \cdot n_{v_lim} \quad P_{car_lim} = 862.51 \text{ lbf}$$

Ultimate Downward Load Factor:

$$n_{v_ult} := n_{AD} \cdot n_{sf} \cdot n_{ff} \quad n_{v_ult} = 5.17$$

Ultimate Downward Load of Suspended Cargo:

$$P_{car_ult} := W_{car} \cdot n_{v_ult} \quad P_{car_ult} = 1293.8 \text{ lbf}$$

5.2 Reactions

Cargo Arm 79230-01 Lug Strength Analysis Under Transverse Loading (See Figure 6.2.1)

LOCAL PLATE THICKNESS = 0.75"

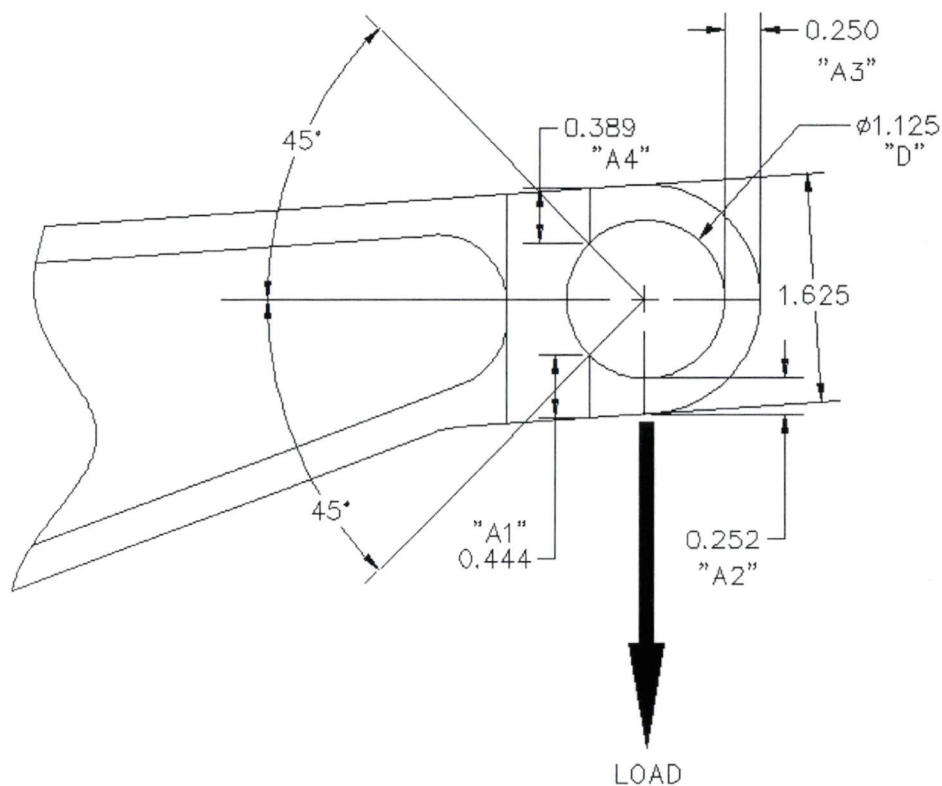


Figure 6.2.1

From Figure 6.2.1

$$t_{\text{lug_01}} := 0.75 \cdot \text{in}$$

$$D_{\text{lug_01}} := 1.125 \cdot \text{in}$$

$$A1 := t_{\text{lug_01}} \cdot 0.444 \cdot \text{in}$$

$$A2 := t_{\text{lug_01}} \cdot 0.250 \cdot \text{in}$$

$$A3 := t_{\text{lug_01}} \cdot 0.250 \cdot \text{in}$$

$$A4 := t_{\text{lug_01}} \cdot 0.389 \cdot \text{in}$$

$$A_{\text{av}} := \frac{6}{\frac{3}{A1} + \frac{1}{A2} + \frac{1}{A3} + \frac{1}{A4}}$$

$$A_{\text{br}} := D_{\text{lug_01}} \cdot t_{\text{lug_01}}$$

$$A1 = 0.333 \text{ in}^2$$

$$A2 = 0.187 \text{ in}^2$$

$$A3 = 0.187 \text{ in}^2$$

$$A4 = 0.292 \text{ in}^2$$

$$A_{\text{av}} = 0.26 \text{ in}^2$$

$$A_{\text{br}} = 0.844 \text{ in}^2$$

See Bruhn, Figure D1.15:

$$\frac{A_{av}}{A_{br}} = 0.308$$

Use Curve 10, Therefore

$$K_{tu} := 0.05$$

Matl Properties of 6061-T6 (LT Value)

$$F_{tu_6061} := 37\text{-ksi}$$

From Bruhn, D1.12:

Load Capacity of the lug

$$P_{tu} := K_{tu} \cdot A_{br} \cdot F_{tu_6061}$$

$$P_{tu} = 1561\text{ lbf}$$

Margin of Safety:

$$MS_{lug_01} := \frac{P_{tu}}{P_{car_ult}} - 1$$

$$MS_{lug_01} = 0.207$$

MARGIN OF SAFETY IS POSITIVE

Cargo Arm 79230-02 Lug Strength Analysis Axial Loading - Failure in Tension (See Figure 6.2.2)

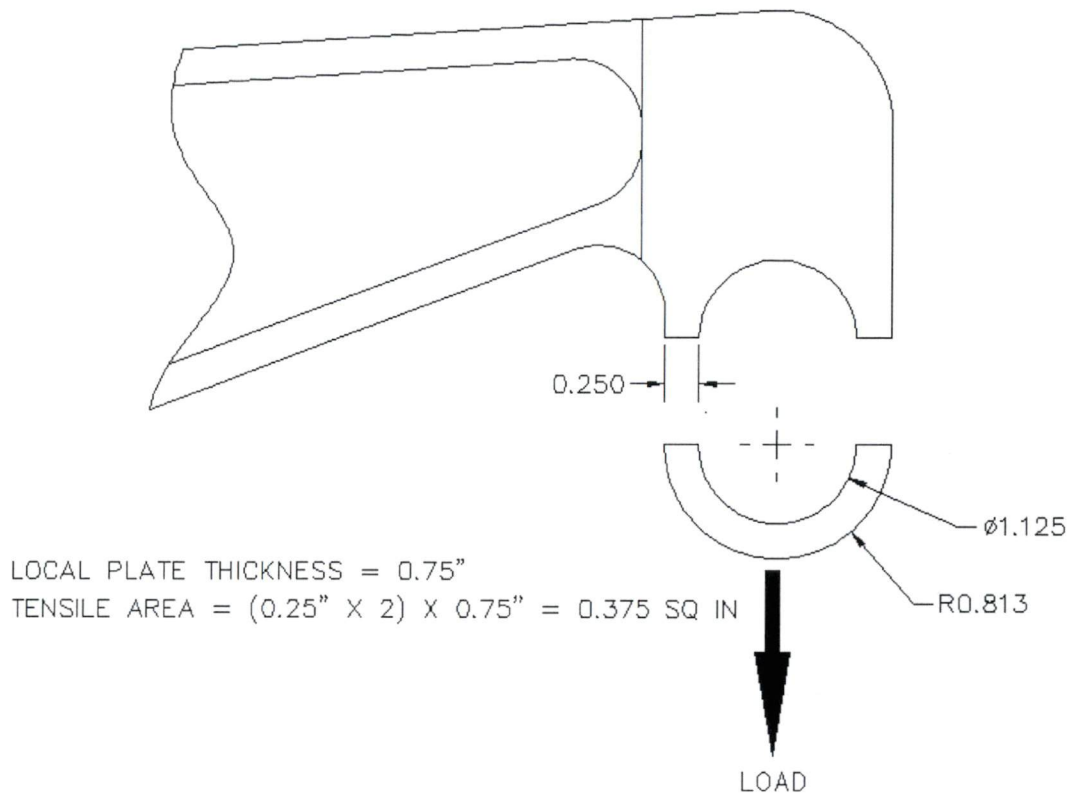


FIGURE 6.2.2

From Figure 6.2.2

$$t_{lug_02} := 0.75 \cdot \text{in}$$

$$A_{T_lug_02} := 2 \cdot t_{lug_02} \cdot 0.25 \cdot \text{in} \quad \text{Tensile area of lug}$$

$$A_{T_lug_02} = 0.375 \text{ in}^2$$

Stress :

$$\sigma_{lug_02} := \frac{P_{car_ult}}{A_{T_lug_02}} \quad \text{Tensile stress on lug}$$

$$\sigma_{lug_02} = 3.45 \text{ ksi}$$

$$\text{Matl Properties of 6061-T6 (LT Value)} \quad F_{tu_6061} := 37 \cdot \text{ksi}$$

Margin of Safety:

$$MS_{T_lug_02} := \frac{F_{tu_6061}}{\sigma_{lug_02}} - 1$$

$$MS_{T_lug_02} = 9.725$$

MARGIN OF SAFETY IS POSITIVE

Cargo Arm 79230-02 Lug Strength Analysis Axial Loading - Failure in Shear (See Figure 6.2.3)

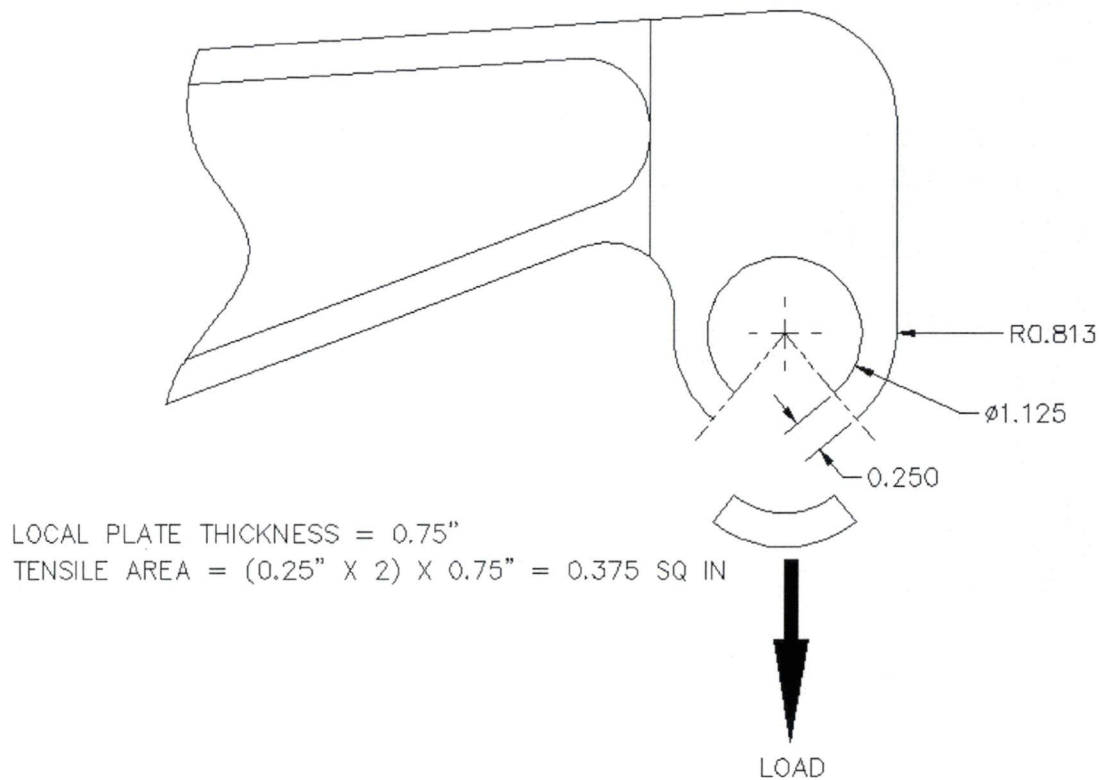


FIGURE 6.2.3

From Figure 6.2.3

$$t_{lug_02} := 0.75 \cdot \text{in}$$

$$A_{S_lug_02} := 2 \cdot t_{lug_02} \cdot 0.25 \cdot \text{in} \quad \text{Shear area of lug}$$

$$A_{S_lug_02} = 0.375 \text{ in}^2$$

Stress :

$$\tau_{lug_02} := \frac{P_{car_ult}}{A_{S_lug_02}} \quad \text{Shear stress on lug}$$

$$\tau_{lug_02} = 3.45 \text{ ksi}$$

$$\text{Matl Properties of 6061-T6 (LT Value)} \quad F_{su_6061} := 19 \cdot \text{ksi}$$

Margin of Safety:

$$MS_{T_lug_02} := \frac{F_{su_6061}}{\tau_{lug_02}} - 1$$

$$MS_{T_lug_02} = 4.507$$

MARGIN OF SAFETY IS POSITIVE

Bending of the Cargo Arm (see Figure 6.2.4)

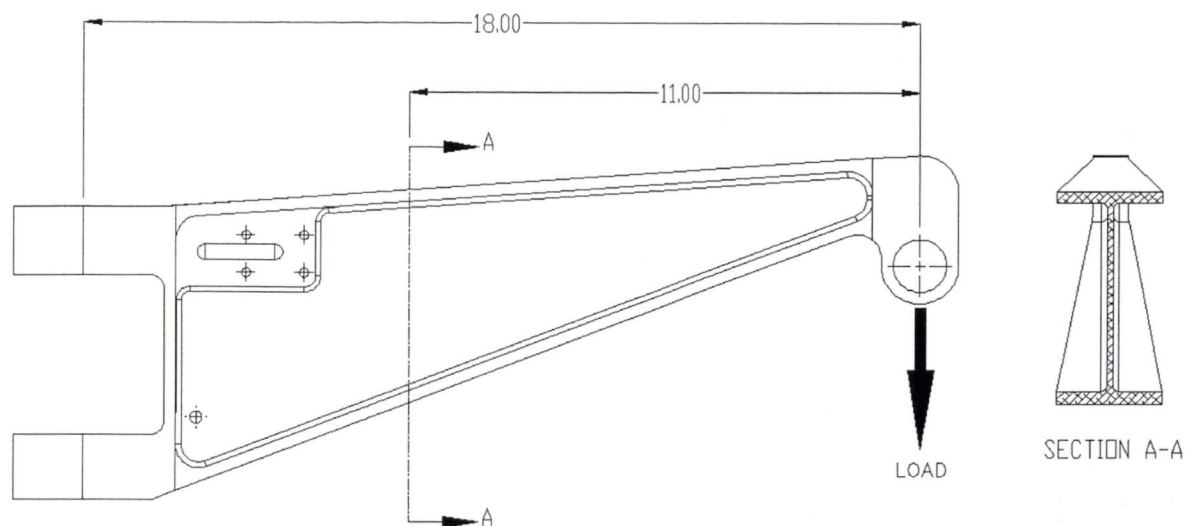


FIGURE 6.2.4

	Moment of Inertia	$I_{\text{arm}} := 6.06 \cdot \text{in}^4$
	Centroid	$c_{\text{arm}} := 2.3 \cdot \text{in}$
$M_{\text{arm}} := 11 \cdot \text{in} \cdot P_{\text{car_ult}}$	Bending Moment	$M_{\text{arm}} = 14231.2 \cdot \text{in} \cdot \text{lbf}$
Stress		
$\sigma_{\text{arm}} := \frac{M_{\text{arm}} \cdot c_{\text{arm}}}{I_{\text{arm}}}$		$\sigma_{\text{arm}} = 5.4 \cdot \text{ksi}$
Margin of Safety:		
$MS := \frac{F_{\text{tu_6061}}}{\sigma_{\text{arm}}} - 1$		$MS = 5.1$

MARGIN OF SAFETY IS POSITIVE

The finish specification definition is the only change applied to the Rappel Step components.

6.0 STRUCTURAL ANALYSIS OF ELEMENT CHANGES – BRACKET

6.1 Loads and Factors (review from ER801.01)

Factors

Inertia Forces (Ultimate) per 29.561

Upward	$n_{ult_up} := 1.5$
Forward	$n_{ult_fwd} := 4.0$
Sideward	$n_{ult_side} := 2.0$
Downward	$n_{ult_down} := 4.0$

Shoulder Harness Attachment
Multiplication Factor Per 29.785 $n_{mf} := 1.33$

Loads

AC 29-2B para 335A b. (3) states;

(3) Shoulder harnesses need only be substantiated for 40 percent of total occupant load rather than the former 60 percent adopted by Amendment 29-24.

This analysis will conservatively substantiate for 60% of the occupant's load, therefore the applicable loads for analysis are;

Weight of Occupant	per 29.785	$wt_{occ} := 170 \text{ lbf}$
Upward	$P_{ult_up} := n_{ult_up} \cdot n_{mf} \cdot wt_{occ} \cdot .6$	$P_{ult_up} = 203.49 \text{ lbf}$
Forward	$P_{ult_fwd} := n_{ult_fwd} \cdot n_{mf} \cdot wt_{occ} \cdot .6$	$P_{ult_fwd} = 542.64 \text{ lbf}$
Sideward	$P_{ult_side} := n_{ult_side} \cdot n_{mf} \cdot wt_{occ} \cdot .6$	$P_{ult_side} = 271.32 \text{ lbf}$
Downward	$P_{ult_down} := n_{ult_down} \cdot n_{mf} \cdot wt_{occ} \cdot .6$	$P_{ult_down} = 542.64 \text{ lbf}$

6.2 Reactions

Analysis - Bracket Threads in Shear - Engaged with Helicoil

Assumption: Thread Engagement is 1.0 x Bolt Dia., 1/4 inch dia (assumed smaller than actual and therefore this analysis shall conservatively work with less shear area).

Mechanical Properties of Thread Engagement:

$$D_{AN4} := 0.25 \text{ in}$$

$$L_{\text{engage}} := D_{AN4} \cdot 1.0$$

$$L_{\text{engage}} = 0.25 \text{ in}$$

Pitch Diameter:

$$D_{p_25} := 0.227 \text{ in}$$

$$A_{s_25} := \pi \cdot D_{p_25} \cdot L_{\text{engage}} \cdot 0.5$$

$$A_{s_25} = 0.089 \text{ in}^2$$

$$\tau_{\text{thread_25}} := \frac{P_{\text{ult_side}}}{A_{s_25}}$$

$$\tau_{\text{thread_25}} = 3043.7 \text{ psi}$$

Mechanical Properties of 6061-T651
Per MMPDS-01

Shear

$$F_{su_6061} := 26 \text{ ksi}$$

Margin of Safety:

$$MS_{\text{thread_25}} := \left(\frac{F_{su_6061}}{\tau_{\text{thread_25}}} \right) - 1$$

$$MS_{\text{thread_25}} = 7.5$$

MARGIN OF SAFETY IS POSITIVE

Analysis of the Bracket

Forward Load (See FIGURE 6.2.1)

Eccentric Load Analysis of Bracket - Reaction at "B" and "D" - Reactions are equal, but opposite.

$$\tau_{\text{fwd_ecc}} := \frac{P_{\text{ult_fwd}} \cdot 1.75 \cdot \text{in}}{2 \cdot 1.19 \cdot \text{in}} \quad \tau_{\text{fwd_ecc}} = 399 \text{ lbf}$$

Reactions at "B" and "D" due to forward load.

$$\tau_{\text{fwd_fwd}} := \frac{P_{\text{ult_fwd}}}{2} \quad \tau_{\text{fwd_fwd}} = 271.32 \text{ lbf}$$

Resolved Reactions at "B" and "D"

$$R_B := \tau_{\text{fwd_ecc}} + \tau_{\text{fwd_fwd}} \quad \text{CRITICAL} \quad R_B = 670.32 \text{ lbf}$$

$$R_D := -\tau_{\text{fwd_ecc}} + \tau_{\text{fwd_fwd}} \quad R_D = -127.68 \text{ lbf}$$

Section Area and "B"

$$A_B := 0.125 \cdot \text{in}^2$$

Mechanical Properties 6061-T6 (LT Value)

Tension

$$F_{\text{tu_6061}} := 37 \cdot \text{ksi}$$

Stress

$$\sigma_B := \frac{R_B}{A_B} \quad \sigma_B = 5362.6 \text{ psi}$$

Margin of Safety

$$MS_{\text{fwd_bracket_B}} := \frac{F_{\text{tu_6061}}}{\sigma_B} - 1 \quad MS_{\text{fwd_bracket_B}} = 5.9$$

MARGIN OF SAFETY IS POSITIVE

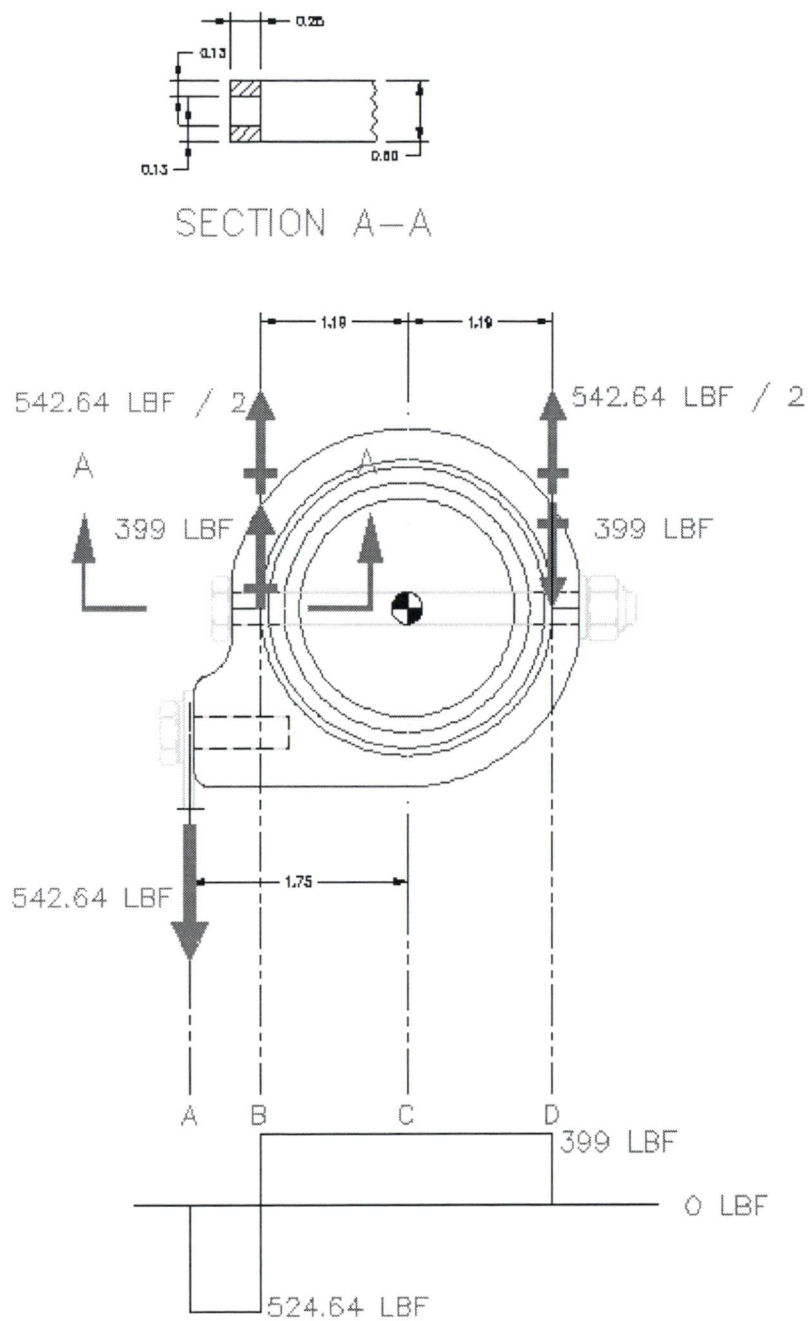


FIGURE 6.2.1

7.0 OTHER COMPLIANCE ITEMS

A review of compliance items 29.785(A) and 29.785(E) *Seats, Births, Litters, Safety Belts and Harnesses* has been conducted. Section 8 and Section 9 of ER758.01 *Engineering Report* remain relevant to new and revised elements of the Rappel Mount Provision and Cargo Deployment Arm.

DOCUMENT CONTROL LIST

DOCUMENT NO.	DOCUMENT CONTENT	REVISION
INSTALLATION DOCUMENTS		
75801	Rappel Mount Provision Installation	1
ICA758.90	Instructions for Continued Airworthiness	2
FMS758.90	Flight Manual Supplement	2
FABRICATION DOCUMENTS		
DCL758-2	Document Control List – Rappel Mount Provision Assembly	2
ENGINEERING DOCUMENTS		
APPROVAL:	ORIGINAL DATE: 07 May 2008 REVISION DATE: 14 January 2009	AERO DESIGN LTD. 2013 – 39 th Ave NE, Calgary, Alberta, T2E 6R7 Ph. (403) 250-8027 Fax. (403) 250-8333
	SHEET 1 OF 1	Bell 212, 412, 205A-1, 205B Rappel Mount Provision Installation
	DCL758-1	Rev. 3

Emited and

To Be Completed by
Greg O TCA.

DOCUMENT CONTROL LIST

DOCUMENT NO.	DOCUMENT CONTENT	REVISION
INSTALLATION DOCUMENTS		
FABRICATION DOCUMENTS		
75820	Rappel Mount Assembly	1
75824	Assembly, Plug, STN 105	2
75825	Assembly, Plug, Guide	2
75826	Assembly, Plug, 131	2
75830	Tube	1
75831	Retainer	1
75832	Guide	1
75833	Stanchion Adapter	1
75834	Curved Washer	1
75835	Gate Parts	1
75837	Placards	0
75821	Assembly, Guard Ring	0
75822	Assembly, Bearing Ring	0
ENGINEERING DOCUMENTS		
ER758.01	Engineering Report	0
ER808.01	Engineering Report	0
APPROVAL:	ORIGINAL DATE: 07 May 2008 REVISION DATE: 14 January 2009	AERO DESIGN LTD. 2013 – 39 th Ave NE, Calgary, Alberta, T2E 6R7 Ph. (403) 250-8027 Fax. (403) 250-8333
	SHEET 1 OF 1	Bell 212, 412, 205A-1, 205B Rappel Mount Provision Assembly
	DCL758-2	Rev. 2

DOCUMENT CONTROL LIST

DOCUMENT NO.	DOCUMENT CONTENT	REVISION
INSTALLATION DOCUMENTS		
79201	Cargo Deployment Arm Installation	2
ICA758.90	Instructions for Continued Airworthiness	2
FMS792.90	Flight Manual Supplement	2
FMS758.90	Flight Manual Supplement	2
FABRICATION DOCUMENTS		
DCL792-2	Document Control List Cargo Arm Assembly	2
ENGINEERING DOCUMENTS		
APPROVAL:	ORIGINAL DATE: 07 May 2008 REVISION DATE: 14 January 2009	AERO DESIGN LTD. 2013 – 39 th Ave NE, Calgary, Alberta, T2E 6R7 Ph. (403) 250-8027 Fax. (403) 250-8333
	SHEET 1 OF 1	Bell 212, 412, 205A-1, 205B Cargo Deployment Arm Installation
	DCL792-1	
	Rev. 3	

DOCUMENT CONTROL LIST

DOCUMENT NO.	DOCUMENT CONTENT	REVISION
INSTALLATION DOCUMENTS		
FABRICATION DOCUMENTS		
79220	Cargo Deployment Arm Assembly	2
79230	Cargo Arm	1
79231	Bearing Sleeve	1
79232	Cover	1
79233	Bushing	0
79234	Sleeve	0
79235	Lock Leaver	1
79236	Bushing	1
79237	Bushings	1
79221	Cover	0
80120	Bracket	1
79238	Placards	0
ENGINEERING DOCUMENTS		
ER758.01	Engineering Report	0
ER801.01	Engineering Report	0
ER808.01	Engineering Report	0
APPROVAL:	ORIGINAL DATE: 07 May 2008	AERO DESIGN LTD. 2013 – 39 th Ave NE, Calgary, Alberta, T2E 6R7 Ph. (403) 250-8027 Fax. (403) 250-8333
	REVISION DATE: 14 January 2009	
	SHEET 1 OF 1	Bell 212, 412, 205A-1, 205B Cargo Deployment Arm Assembly
	DCL792-2	Rev. 2

DOCUMENT CONTROL LIST

DOCUMENT NO.	DOCUMENT CONTENT	REVISION
INSTALLATION DOCUMENTS		
79801	Rappel Step Installation	0
ICA758.90	Instructions for Continued Airworthiness	2
FABRICATION DOCUMENTS		
DCL798-2	Document Control List Rappel Step Assembly	1
ENGINEERING DOCUMENTS		
APPROVAL:	ORIGINAL DATE: 14 May 2008 REVISION DATE: 14 January 2009	AERO DESIGN LTD. 2013 – 39 th Ave NE, Calgary, Alberta, T2E 6R7 Ph. (403) 250-8027 Fax. (403) 250-8333
	SHEET 1 OF 1	Bell 212, 412, 205A-1, 205B Rappel Step Installation
	DCL798-1	Rev. 2

DOCUMENT CONTROL LIST

DOCUMENT NO.	DOCUMENT CONTENT	REVISION
INSTALLATION DOCUMENTS		
FABRICATION DOCUMENTS		
79820	Rappel Step Assembly	0
79830	Step	1
79831	Mounting Plate STN 84	1
79832	Mounting Plate STN 129	1
79833	Block	1
79834	Kick Plate	1
79835	Bushing	1
78230	Step Extrusion	1
ENGINEERING DOCUMENTS		
ER758.01	Engineering Report	0
TP798.02	Test Plan/Report	0
APPROVAL:	ORIGINAL DATE: 14 May 2008	AERO DESIGN LTD. 2013 – 39 th Ave NE, Calgary, Alberta, T2E 6R7 Ph. (403) 250-8027 Fax. (403) 250-8333
	REVISION DATE: 14 January 2009	
	SHEET 1 OF 1	Bell 212, 412, 205A-1, 205B Rappel Step Assembly
DCL798-2		Rev. 1

Transport
CanadaTransports
Canada

1100-9700 Jasper Avenue
Edmonton, Alberta
T5J 4E6

Your file Votre référence

Our file Notre référence
C-08-0641
5010-0402

January 20, 2009

AERO Design Limited
2013 39 Ave. NE
Calgary, AB
T2E 6R7

**SUBJECT: Extension of DAR 290M Authority – Bell 212, 412 and 205 series rotorcraft,
Installation of Rappel and Cargo Deployment Provisions, SH09-2**

This is in response to your July 28, 2008 request for extension of delegation to cover the subject design change. You are hereby authorized to make findings of compliance for the following Airworthiness Standard as listed in Compliance Plan CP758-1, CP758-2 and CP798:

29.251 Vibration
29.865(a) and (e) External Loads

This is a one-time extension, granted in accordance with Airworthiness Manual, Chapter 505.223(a) and is limited to be exercised for this approval only. Approval number SH09-2 has been assigned for your use.

If you have any questions or wish to discuss this project further, please contact the project OPI, Greg Oucharek at the Calgary TCC.

Yours truly,

F.J.B. Wright
Regional Manager Aircraft Certification
Prairie and Northern Region
Phone: (780) 495-3856
Fax: (780) 495-7963

AIRWORTHINESS REQUIREMENTS COMPLIANCE PROGRAM

CP798

APPLICANT: AERO Design Ltd.
2013 - 39th Ave N.E.
Calgary, Alberta
T2E 6R7

DATE: 07 May, 2008
REV. No. 1 28 July 2008

CORRESPONDANCE TO: AERO Design Ltd.
(If other than applicant) 2013 - 39th Ave N.E.
Calgary, Alberta
T2E 6R7

MAKE: Bell Helicopter
MODEL: 212, 412, 205A-1, 205B

REGISTRATION:
SERIAL No.:

NATURE OF WORK: Rappel Step installed on Helicopter Hardpoints

MODEL CERTIFICATION BASIS: FAR 29, at amendment 29-2
MODIFICATION CERTIFICATION BASIS: FAR 29, at amendment 29-2

Airworthiness Requirement	Subject for Compliance or Documentary Proof	Form of Substantiation	DOT	DAR	Comments
Subpart B	Flight				
29.29	Empty Weight & Corresponding CG	Installation Drawing			
29.45 – 29.79	Performance	N/A - Not Significant			Position and size of this installation will not significantly alter the performance and flight characteristics of the type approved aircraft.
29.141 – 29.241	Flight Characteristics	N/A - Not Significant			
29.251	Vibration	Flight Test		**	TP798.02 Flight
Subpart C	Structure				
29.301	Loads - Personnel	Engineering Report		X	Design loads appropriate to function are used.
29.301	Loads – Air	Statement		X	
29.303	Factor of Safety	Engineering Report		X	
29.305	Strength and Deformation	Engineering Report		X	
29.307	Proof of Structure	Engineering Report		X	
29.337	Manouvering Load Factor	N/A			Rappeler is attached to a belay line, which supports the majority of his weight. Helicopter is normally in a hover at this time. The step is an aid to stepping down to the landing gear tube.
Subpart D	Design & Construction				
29.601	Design	N/A			There are no unusual features on this installation.
29.603	Materials	Engineering Report		X	
29.605	Fabrication Methods	Fabrication Drawing		X	

AIRWORTHINESS REQUIREMENTS
COMPLIANCE PROGRAM

Airworthiness Requirement	Subject for Compliance or Documentary Proof	Form of Substantiation	DOT	DAR	Comments
29.609	Protection of Structure	Fabrication Drawing		X	
29.613	Material Strength Properties & Design Values	Fabrication Drawing		X	

Items marked with the symbol ** require extension of delegation (see attached cover letter).

AERO DESIGN LTD.

2013 - 39 Avenue N.E., Calgary, Alberta, T2E 6R7

Tel: 403-250-8027

Fax: 403-250-8333

www.aerodesign.ca

23 July, 2008

Transport Canada
Aircraft Certification Division
800-1601 Airport Road
Calgary, Alberta
T2E 6Z8

Attn: Greg Oucharek

Your File : C-08-0641

Our File : 808

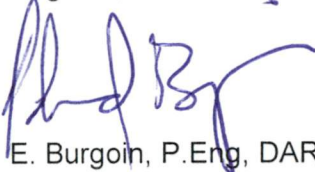
Re: Extension of Delegation

Greg,

Please extend my delegation to include the following paragraphs listed on compliance program CP758-1, Revision 1 and CP758-2, Revision 2.

29.865(a) External Loads
29.865(e) External Loads

Regards,

A handwritten signature in blue ink, appearing to read 'E. Burgoin', is written over the typed name.

E. Burgoin, P.Eng, DAR 290M

AERO DESIGN LTD.

2013 – 39 Avenue N.E., Calgary, Alberta, T2E 6R7

Tel: 403-250-8027

Fax: 403-250-8333

www.aerodesign.ca

23 July, 2008

Transport Canada
Aircraft Certification Division
800-1601 Airport Road
Calgary, Alberta
T2E 6Z8

Attn: Greg Oucharek

Your File : C-08-0641

Our File : 808

Re: Installation of Rappel Mount Provision and Cargo Deployment Provision

Greg,

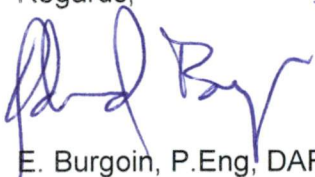
Please find attached the following documents related to this project:

Modification Approval Request Application Form
Compliance Program
Compliance Program
Compliance Program
Project Summary

MOD808
CP758-1
CP758-2
CP798
PS808

Revision 0
Revision 1
Revision 2
Revision 0
Revision 0

Regards,



E. Burgoin, P.Eng, DAR 290M

Encl.

MODIFICATION APPROVAL REQUEST APPLICATION FORM

MOD808, Rev. 0

1. NAME AND ADDRESS OF APPLICANT: AERO Design Ltd. 2013 - 39 th AVE NE Calgary, AB T2E 6R7		2. IDENTIFICATION OF PRODUCT				
		MAKE: Bell		MODEL: 205A-1, 205B, 212, 412		
ALL CORRESPONDANCE TO: AERO Design Ltd. 2013 39th Ave N.E. Calgary, AB T2E 6R7		SERIAL No.: ALL ELIGIBLE		REGISTRATION: ALL ELIGIBLE		
3. REQUEST FOR:						
A. SUPPLEMENTAL TYPE CERTIFICATE (STC)		<input checked="" type="checkbox"/>				
B. STC/STA REVISION		<input type="checkbox"/> STC/STA No.				
C. LIMITED SUPPLEMENTAL TYPE CERTIFICATE (LSTC)		<input type="checkbox"/>				
D. LIMITED STC/STA REVISION		<input type="checkbox"/> LSTC/LSTA No.				
E. F.A.A. SUPPLEMENTAL TYPE CERTIFICATE		<input type="checkbox"/>				
F. F.A.A. STC REVISION		<input type="checkbox"/> STC No.				
G. FAMILIARIZATION OF F.A.A. STC		<input type="checkbox"/> STC No.				
H. REPAIR DESIGN APPROVAL (RDC)		<input type="checkbox"/>				
I. PARTS DESIGN APPROVAL (PDA)		<input type="checkbox"/>				
4. TITLE OF MODIFICATION OR REPAIR: Installation of a rappel mount provision and cargo deployment provision.						
5. BRIEF DESCRIPTION OF MODIFICATION OR REPAIR: The installation provides an aircraft mount for rappelling and cargo deployment operations by trained personnel (ie. rappelling fire fighters).						
6. APPLICABLE TYPE APPROVAL (TA) OR TYPE CERTIFICATE (TC) DOCUMENTS:						
A. TA NO. <u>H-86</u> B. TC No. <u>H1SW</u> C. OTHER _____						
7. PROPOSED BASIS OF APPROVAL:						
A. SAME AS TA <input checked="" type="checkbox"/> B. SAME AS TC <input type="checkbox"/> C. OTHER <input type="checkbox"/> (Please specify) _____						
8. DOCUMENTATION CHECKLIST		REQUIRED		FOR DOT USE ONLY		
		YES	NO	RECEIVED		
		YES	NO	YES	NO	DATE
COMPLIANCE PROGRAM		X				
MASTER DRAWING LIST		X				
FLIGHT MANUAL SUPPLEMENT		X				
MAINTENANCE MANUAL SUPPLEMENT			X			
INSTRUCTIONS FOR CONTINUING AIRWORTHINESS		X				
ENGINEERING REPORTS		X				
DESIGN DRAWINGS			X			
MANUFACTURE DRAWINGS & INSTALLATION INSTRUCTIONS		X				
ELECTRICAL LOAD ANALYSIS			X			
DRAFT STC, LSTC OR RDA		X				
WEIGHT AND MOMENT CHANGE		X				
FLIGHT TEST DATA		X				
OTHER (Specify)			X			
9. APPLICANT'S REMARKS:						
10. In addition to the payment of Aircraft Certification approval fees as prescribed in Canadian Aviation Regulations (CAR) Section 104, I agree to reimburse Transport Canada incremental expenses as in Aviation Regulation Directive No. 3, or equivalent, as applicable. For further details governing cost recovery, refer to AMA 513/4. AERO Design Ltd. PER: <u>[Signature]</u> Consultant 23 July, 2008 SIGNATURE OF APPLICANTS TITLE DATE						
11. _____ SIGNATURE OF REGIONAL ENGINEER DATE						

Title: Rappelling Provisions
Cargo Deployment Provisions

Approval: STC

Manufacture: Mfd by Aero Design (amend Approved Product List)

Customer:

Type and Model: Bell models 205A-1, 205B, 212, and 412

Definition Of Change:

Description:

Provincial Forestries use Bell medium helicopters for initial response to fires. At the fire location there may not be suitable landing areas that can accommodate the helicopter within a reasonable distance.

Fire fighting personnel disembark the helicopter while it hovers by rappelling down lines suspended from anchor points on the helicopter. They make use of rappelling harnesses, ropes and braking devices designed specifically for this type of application in other non-aviation environments and built to accepted international standards.

Their equipment is slung out of the passenger compartment and lowered to the ground in a controlled manner on lines attached to the cargo.

A load-master, a permanent crew member of the helicopter coordinates and controls both the disembarkment of personnel and the deployment of their equipment and cargo.

Both the rappel lines and the cargo deployment lines are released from the helicopter as soon as equipment or personnel are safely on the ground.

Primary Changes to the Aeronautical Product:

Installation of attachment provisions from which equipment can be lowered to the ground capable of supporting the maximum cargo load at ultimate maneuvering load.

Installation of attachment provisions for attaching rappel lines capable of supporting maximum personnel loads including any equipment they may be carrying.

Secondary Changes to the Aeronautical Product (Required as consequence of primary changes):

None

Other Relevant Modifications to the Aeronautical Product (Which impact on this change):

Substantial Change Evaluation:

The scope of this change is not substantial.

Significant Change Evaluation:

Refer to AMA 500/16, Appendix A, Tables A.2.1 through A.5.6, as applicable.

- Yes ☐ No ☒ The change is an example on the table of Significant Changes.
Yes ☐ No ☒ The change is close to an example on the table of Significant Changes.
Yes ☐ No ☒ The change is an example on the table of Not-Significant Changes.
Yes ☐ No ☒ The change is close to an example on the table of Not-Significant Changes.
Yes ☒ No ☐ The change is not an example on the tables.

- A. Is the general configuration changed? Yes ☐ No ☒
A change to the general configuration at the product level that is likely to require a new model designation because of the need to distinguish the different product with other product models (eg. performance, interchangeability of major components etc).
- B. Are the principles of construction changed? Yes ☐ No ☒
A change at the product level to the materials and/or construction methods that affects the overall product's operating characteristics or inherent strength.
- C. Have the assumptions used for certification been invalidated? Yes ☐ No ☒
Changes to product level assumptions, either design or engineering, associated with product development, compliance demonstration, performance or operating envelope that by themselves are so different, that the original assumptions are invalidated and the existing substantiation cannot be extrapolated to cover the changed product.

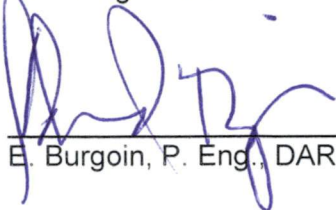
Basis of Certification of the Basic Aeronautical Product:

Type Certificate Data Sheet: H1SW

Basis of Certification for the Change to the Aeronautical Product:

Same as the original basis of certification on the Type Certificate Data Sheet.

Under the authority vested in me by the Minister, I have examined the change in type design listed above according to the established procedures and hereby determine that it is not significant pursuant to subsection 511.13(3) or 513.07(3) of the CARS, to the best of my knowledge and belief.



E. Burgoin, P. Eng., DAR 290M

23, July 2008
Date

AIRWORTHINESS REQUIREMENTS COMPLIANCE PROGRAM

CP758-01

APPLICANT: AERO Design Ltd.
 2013 - 39th Ave N.E.
 Calgary, Alberta
 T2E 6R7

DATE: 01 October 2007
 REV. No. 1 23 July 2008

CORRESPONDANCE TO: AERO Design Ltd.
 (If other than applicant) 2013 - 39th Ave N.E.
 Calgary, Alberta
 T2E 6R7

MAKE: Bell
 MODEL: 205A-1, 205B, 212, and 412

REGISTRATION:
 SERIAL No.:

NATURE OF WORK: Cargo deployment from hover - Forestry applications

MODEL CERTIFICATION BASIS: FAR 29, Amendment 2 and CAR 7 Amendment 4 for 205A-1 and 205B
 MODIFICATION CERTIFICATION BASIS: FAR 29, Amendment 2 and Amend 29-43 for 29.865(a) and 29.865(e)

Airworthiness Requirement	Subject for Compliance or Documentary Proof	Form of Substantiation	DOT	DAR	Comments
Subpart B - Flight					
29.29	Empty weight and CofG	Installation weight and moment on drawings		X	
Subpart C - Strength Requirements					
29.301	Loads	Analysis		X	
29.303	Factor of safety	Analysis		X	
29.305	Strength and deformation	Analysis		X	
29.307(a)	Proof of structure	Analysis		X	
29.309(a)	Design limitations - design maximum weight	Limitation		X	Design max weight for this piece of equipment only
29.309(d)	Design limitations - maximum rearward and sideward flight speeds	Limitation		X	Speed limitations for deployment phase of flight only.
29.337(a)	Limit maneuvering load factor	Analysis		X	
29.341	Gust loads	N/A			Loads only applied in hover phase of flight
29.351	Yawing conditions	N/A			Loads only applied in hover phase of flight
29.561	Emergency Landing Conditions	N/A			
Subpart D - Design and Construction					
29.601	Design	Statement		X	
29.603	Materials	Design		X	

AIRWORTHINESS REQUIREMENTS COMPLIANCE PROGRAM

Airworthiness Requirement	Subject for Compliance or Documentary Proof	Form of Substantiation	DOT	DAR	Comments
29.605	Fabrication methods	Design		X	No processes that require close control being applied in the design.
29.609	Protection of Structure	Specifications on drawings		X	
29.611	Inspection provisions	Design		X	
29.613	Material strength properties and design values	Use of materials listed in Mil-Hdbk 5		X	
29.619	Special factors	Compliance with 29.623 and 29.625		X	
29.623	Bearing Factors	Analysis		X	
29.625	Fitting Factors	Analysis		X	
29.785(a)	Seats, births, litters, safety belts, and harnesses.	Analysis		X	
29.785(e)	Seats, births, litters, safety belts, and harnesses.	Analysis		X	
29.865(a)	External Loads	Analysis		**	Limitation: Rappel/Cargo operations while helicopter in hover only.
29.865(e)	External Loads	Flight Manual Supplement		**	
Subpart F – Equipment					
29.1301	Function and installation	Design		X	
Subpart G – Limitations					
29.1501	Operating limitations – General	Provision of Flight Manual Supplement (FMS) Placards	X		
29.1503	Airspeed limitations	Limitation in FMS	X		Limitation to hover and low translational speeds during deployment phase
29.1523	Minimum crew	Limitation in FMS	X		Load-master shall be on-board in addition to pilot
29.1525	Kinds of operation	Limitation in FMS	X		Allows deployment
29.1529	Instructions for Continued Airworthiness	ICA Provided	X		Restricts rotorcraft occupants to crew members and others essential to the operation.
29.1541	Markings and placards	Placards on drawings - weight limitation for deployment		X	
29.1581	Rotorcraft Flight Manual	Provision of FMS	X		
29.1583	FMS Operating Limitations	Provision of limitations in FMS	X		
29.1585	FMS Operating Procedures	Provision of normal and emergency procedures in FMS	X		
29.1587	FMS Performance	N/A			No change from Type Approval

Items marked with the symbol ** require extension of delegation (see attached cover letter).

AIRWORTHINESS REQUIREMENTS COMPLIANCE PROGRAM

CP758-02

APPLICANT: AERO Design Ltd.
2013 - 39th Ave N.E.
Calgary, Alberta
T2E 6R7

CORRESPONDANCE TO: AERO Design Ltd.
(If other than applicant) 2013 - 39th Ave N.E.
Calgary, Alberta
T2E 6R7

DATE: 01 October 2007
REV. No. 2 23 July 2008

MAKE: Bell
MODEL: 205A-1, 205B, 212, and 412

REGISTRATION:
SERIAL No.:

NATURE OF WORK: Rappel Anchor Provision - Forestry applications

MODEL CERTIFICATION BASIS: FAR 29, Amendment 2 and CAR 7 Amendment 4 for 205A-1 and 205B
MODIFICATION CERTIFICATION BASIS: FAR 29, Amendment 2 and Amend 29-43 for 29.865(a) and 29.865(e)

Airworthiness Requirement	Subject for Compliance or Documentary Proof	Form of Substantiation	DOT	DAR	Comments
Subpart B - Flight					
29.29	Empty weight and CofG	Installation weight and moment on drawings		X	
Subpart C - Strength Requirements					
29.301	Loads	Analysis		X	215 lb.95 percentile person plus equipment load
29.303	Factor of safety	Analysis		X	
29.305	Strength and deformation	Analysis		X	
29.307(a)	Proof of structure	Analysis		X	
29.309(a)	Design limitations - design maximum weight	Limitation		X	Design max weight for this piece of equipment only
29.309(d)	Design limitations - maximum rearward and sideward flight speeds	Limitation		X	Speed limitations for rappelling phase of flight only.
29.337(a)	Limit maneuvering load factor	Analysis		X	
29.341	Gust loads	N/A			Loads only applied in hover phase of flight
29.351	Yawing conditions	N/A			Loads only applied in hover phase of flight
29.561	Emergency Landing Conditions	Analysis			Applicable to optional shoulder harness bracket only.
Subpart D - Design and Construction					
29.601	Design	Statement		X	

AIRWORTHINESS REQUIREMENTS COMPLIANCE PROGRAM

Airworthiness Requirement	Subject for Compliance or Documentary Proof	Form of Substantiation	DOT	DAR	Comments
29.603	Materials	Design		X	No processes that require close control being applied in the design.
29.605	Fabrication methods	Design		X	
29.609	Protection of Structure	Specifications on drawings		X	
29.611	Inspection provisions	Design		X	
29.613	Material strength properties and design values	Use of materials listed in Mil-Hdbk 5		X	
29.619	Special factors	Compliance with 29.623 and 29.625		X	
29.623	Bearing Factors	Analysis		X	Applicable to optional shoulder harness bracket only. Limitation: Rappel/Cargo operations while helicopter in hover only.
29.625	Fitting Factors	Analysis		X	
29.785(a)	Seats, births, litters, safety belts, and harnesses.	Analysis		X	
29.785(e)	Seats, births, litters, safety belts, and harnesses.	Analysis		X	
29.785(f)	Seats, births, litters, safety belts, and harnesses.	Analysis		X	
29.865(a)	External Loads	Analysis		**	
29.865(e)	External Loads	Flight Manual Supplement		**	
Subpart F – Equipment					
29.1301	Function and installation	Design		X	
Subpart G – Limitations					
29.1501	Operating limitations – General	Provision of Flight Manual Supplement (FMS) Placards	X		Limitation to hover during rappel phase Load-master shall be on-board in addition to pilot Allows rappelling Restricts rotorcraft occupants to crew members and others essential to the operation.
29.1503	Airspeed limitations	Limitation in FMS	X		
29.1523	Minimum crew	Limitation in FMS	X		
29.1525	Kinds of operation	Limitation in FMS	X		
29.1529	Instructions for Continued Airworthiness	ICA Provided Placards on drawings	X		
29.1541	Markings and placards	- weight limitation for rappelling anchor		X	
29.1581	Rotorcraft Flight Manual	Provision of FMS	X		
29.1583	FMS Operating Limitations	Provision of limitations in FMS	X		
29.1585	FMS Operating Procedures	Provision of normal and emergency procedures in FMS	X		

AIRWORTHINESS REQUIREMENTS
COMPLIANCE PROGRAM

Airworthiness Requirement	Subject for Compliance or Documentary Proof	Form of Substantiation	DOT	DAR	Comments
29.1587	FMS Performance	N/A			No change from Type Approval

Items marked with the symbol ** require extension of delegation (see attached cover letter).

AIRWORTHINESS REQUIREMENTS COMPLIANCE PROGRAM

CP798

APPLICANT: AERO Design Ltd.
2013 - 39th Ave N.E.
Calgary, Alberta
T2E 6R7

DATE: 07 May, 2008
REV. No. 0

CORRESPONDANCE TO: AERO Design Ltd.
(If other than applicant) 2013 - 39th Ave N.E.
Calgary, Alberta
T2E 6R7

MAKE: Bell Helicopter
MODEL: 212, 412, 205A-1, 205B

REGISTRATION:
SERIAL No.:

NATURE OF WORK: Rappel Step installed on Helicopter Hardpoints

MODEL CERTIFICATION BASIS: FAR 29, at amendment 29-2
MODIFICATION CERTIFICATION BASIS: FAR 29, at amendment 29-2

Airworthiness Requirement	Subject for Compliance or Documentary Proof	Form of Substantiation	DOT	DAR	Comments
Subpart B	Flight				
29.29	Empty Weight & Corresponding CG	Installation Drawing			
29.45 -	Performance	N/A - Not Significant			Position and size of this installation will not significantly alter the performance and flight characteristics of the type approved aircraft.
29.79					
29.141 -	Flight Characteristics	N/A - Not Significant			
29.241					
29.251	Vibration	Flight Test		X	TP798.02 Flight
Subpart C	Structure				
29.301	Loads - Personnel	Engineering Report		X	Design loads appropriate to function are used.
29.301	Loads - Air	Statement		X	
29.303	Factor of Safety	Engineering Report		X	
29.305	Strength and Deformation	Engineering Report		X	
29.307	Proof of Structure	Engineering Report		X	
29.337	Manouvering Load Factor	N/A			Rappeler is attached to a belay line, which supports the majority of his weight. Helicopter is normally in a hover at this time. The step is an aid to stepping down to the landing gear tube.
Subpart D	Design & Construction				
29.601	Design	N/A			There are no unusual features on this installation.
29.603	Materials	Engineering Report		X	
29.605	Fabrication Methods	Fabrication Drawing		X	

AIRWORTHINESS REQUIREMENTS
COMPLIANCE PROGRAM

Airworthiness Requirement	Subject for Compliance or Documentary Proof	Form of Substantiation	DOT	DAR	Comments
29.609	Protection of Structure	Fabrication Drawing		X	
29.613	Material Strength Properties & Design Values	Fabrication Drawing		X	

AIRWORTHINESS REQUIREMENTS COMPLIANCE PROGRAM

CP758-02

APPLICANT: AERO Design Ltd.
 2013 - 39th Ave N.E.
 Calgary, Alberta
 T2E 6R7

CORRESPONDANCE TO: AERO Design Ltd.
 (If other than applicant) 2013 - 39th Ave N.E.
 Calgary, Alberta
 T2E 6R7

DATE: 01 October 2007
 REV. No. 2 23 July 2008

MAKE: Bell
 MODEL: 205A-1, 205B, 212, and 412

REGISTRATION:
 SERIAL No.:

NATURE OF WORK: Rappel Anchor Provision - Forestry applications

MODEL CERTIFICATION BASIS: FAR 29, Amendment 2 and CAR 7 Amendment 4 for 205A-1 and 205B
 MODIFICATION CERTIFICATION BASIS: FAR 29, Amendment 2 and Amend 29-43 for 29.865(a) and 29.865(e)

Airworthiness Requirement	Subject for Compliance or Documentary Proof	Form of Substantiation	DOT	DAR	Comments
Subpart B - Flight					
29.29	Empty weight and CofG	Installation weight and moment on drawings		X	
Subpart C – Strength Requirements					
29.301	Loads	Analysis		X	215 lb.95 percentile person plus equipment load
29.303	Factor of safety	Analysis		X	
29.305	Strength and deformation	Analysis		X	
29.307(a)	Proof of structure	Analysis		X	
29.309(a)	Design limitations – design maximum weight	Limitation		X	Design max weight for this piece of equipment only
29.309(d)	Design limitations – maximum rearward and sideward flight speeds	Limitation		X	Speed limitations for rappelling phase of flight only.
29.337(a)	Limit maneuvering load factor	Analysis		X	
29.341	Gust loads	N/A			Loads only applied in hover phase of flight
29.351	Yawing conditions	N/A			Loads only applied in hover phase of flight
29.561	Emergency Landing Conditions	Analysis			Applicable to optional shoulder harness bracket only.
Subpart D – Design and Construction					
29.601	Design	Statement		X	

AIRWORTHINESS REQUIREMENTS COMPLIANCE PROGRAM

Airworthiness Requirement	Subject for Compliance or Documentary Proof	Form of Substantiation	DOT	DAR	Comments
29.603	Materials	Design		X	No processes that require close control being applied in the design.
29.605	Fabrication methods	Design		X	
29.609	Protection of Structure	Specifications on drawings		X	
29.611	Inspection provisions	Design		X	
29.613	Material strength properties and design values	Use of materials listed in Mil-Hdbk 5		X	
29.619	Special factors	Compliance with 29.623 and 29.625		X	
29.623	Bearing Factors	Analysis		X	
29.625	Fitting Factors	Analysis		X	
29.785(a)	Seats, births, litters, safety belts, and harnesses.	Analysis		X	
29.785(e)	Seats, births, litters, safety belts, and harnesses.	Analysis		X	
29.785(f)	Seats, births, litters, safety belts, and harnesses.	Analysis		X	Applicable to optional shoulder harness bracket only.
29.865(a)	External Loads	Analysis		**	Limitation: Rappel/Cargo operations while helicopter in hover only.
29.865(e)	External Loads	Flight Manual Supplement		**	
Subpart F – Equipment					
29.1301	Function and installation	Design		X	
Subpart G – Limitations					
29.1501	Operating limitations – General	Provision of Flight Manual Supplement (FMS) Placards	X		
29.1503	Airspeed limitations	Limitation in FMS	X		Limitation to hover during rappel phase Load-master shall be on-board in addition to pilot Allows rappelling Restricts rotorcraft occupants to crew members and others essential to the operation.
29.1523	Minimum crew	Limitation in FMS	X		
29.1525	Kinds of operation	Limitation in FMS	X		
29.1529	Instructions for Continued Airworthiness	ICA Provided Placards on drawings	X		
29.1541	Markings and placards	- weight limitation for rappelling anchor		X	
29.1581	Rotorcraft Flight Manual	Provision of FMS	X		
29.1583	FMS Operating Limitations	Provision of limitations in FMS	X		
29.1585	FMS Operating Procedures	Provision of normal and emergency procedures in FMS	X		

AIRWORTHINESS REQUIREMENTS
COMPLIANCE PROGRAM

Airworthiness Requirement	Subject for Compliance or Documentary Proof	Form of Substantiation	DOT	DAR	Comments
29.1587	FMS Performance	N/A			No change from Type Approval

Items marked with the symbol ** require extension of delegation (see attached cover letter).

CONFORMITY INSPECTION RECORD

Applicant	Aeronautical Product				Title of Change
AERO Design Ltd	Make Bell	Model 212, 412, 205A-1, 205B	Serial No.	Registration	Cargo Deployment Arm
Drawing No.	Applicant's Inspector		T.C. Inspection		Findings/DCNs
	Signature	Date	Signature	Date	
79201 R1	<i>[Signature]</i>	June 18/88			Change A (DCN 79201 R0) R1)
79220 R1	<i>[Signature]</i>				No placard installed.
79230 R0	<i>[Signature]</i>				Replace AN4-10A with AN4-11A for thread clearance
79231 R0	<i>[Signature]</i>				Change A (DCN 79230 R0)
79232 R0	<i>[Signature]</i>				ADDITIONAL BOLT HOLE IN BEARING SLEEVE DRILLED 90DEG OFF ALIGNMENT. SEE ENGINEERING DISPOSITION ED792-1.
79233 R0	<i>[Signature]</i>				LENGTH OF COVER OUTSIDE OF TOLERANCE. SEE ENGINEERING DISPOSITION ED792-1.
79234 R0	<i>[Signature]</i>				Change A (DCN 79233 R0)
79235 R0	<i>[Signature]</i>				Dim ϕ 2.875 should be ϕ 3.00
79236 R0	<i>[Signature]</i>				
79237 R0	<i>[Signature]</i>				

APPLICANT'S ATTESTATION

I hereby confirm that the prototype installation for the subject

- ☒ MODIFICATION,
☐ REPAIR,
☐ TSO/AP-TC ARTICLE

is in conformity with the applicable installation drawing(s) listed above and that necessary ground tests have been carried out.
 [Please check (✓) the applicable box.]

Additional Information:

Signature: *[Signature]*

TC INSPECTION

- ☒ ACCEPTABLE
☐ UNACCEPTABLE

Remarks:

Signature: *[Signature]* *M. S. Newkirk*

Ref Copy.

CONFORMITY INSPECTION RECORD

Applicant	Aeronautical Product				Title of Change
AERO Design Ltd	Make Bell	Model 212, 412, 205A-1, 205B	Serial No.	Registration	Rappel Mount Provision
Drawing No.	Applicant's Inspector		T.C. Inspection		Findings / DCNs
	Signature	Date	Signature	Date	
75801 RØ	<i>Jeff Clarke</i>	June 18/18			No Plans installed
75820 RØ	<i>Jeff Clarke</i>				Change A (DCN 75801 RØ)
75824 R1	<i>Jeff Clarke</i>				Change A (DCN 75820 RØ)
75825 R1	<i>Jeff Clarke</i>				
75826 R1	<i>Jeff Clarke</i>				
75830 RØ	<i>Jeff Clarke</i>				
75831 RØ	<i>Jeff Clarke</i>				
75832 RØ	<i>Jeff Clarke</i>				
75833 RØ	<i>Jeff Clarke</i>				
75834 RØ	<i>Jeff Clarke</i>				Change A (DCN 75833 RØ)
75835 RØ	<i>Jeff Clarke</i>				Change A (DCN 75835 RØ)
75836 RØ	<i>Jeff Clarke</i>				

APPLICANT'S ATTESTATION

I hereby confirm that the prototype installation for the subject

☒ MODIFICATION,

☐ REPAIR,

☐ TSO/AP-TC ARTICLE

is in conformity with the applicable installation drawing(s) listed above
and that necessary ground tests have been carried out.
[Please check (✓) the applicable box.]

Additional Information:

Signature: *Jeff Clarke*

TC INSPECTION

☒ ACCEPTABLE

☐ UNACCEPTABLE

Remarks:

Signature: *MS Stewart*

CONFORMITY INSPECTION RECORD

Applicant	Aeronautical Product				Title of Change
AERO Design Ltd	Make Bell	Model 212, 412, 205A-1, 205B	Serial No.	Registration	Rappel Step
Drawing No.	Applicant's Inspector Signature Date		T.C. Inspection Signature Date		Findings
79801 RØ	<i>[Signature]</i> June 18/88				
79820 RØ	<i>[Signature]</i>				Rivets Not Staggered and spaced
79830 RØ	<i>[Signature]</i>				Per drawing.
79831 RØ	<i>[Signature]</i>				
79832 RØ	<i>[Signature]</i>				
79833 RØ	<i>[Signature]</i>				
79834 RØ	<i>[Signature]</i>				
79835 RØ	<i>[Signature]</i>				
78230 RØ	<i>[Signature]</i>				

APPLICANT'S ATTESTATION

I hereby confirm that the prototype installation for the subject

- ☒ MODIFICATION,
☐ REPAIR,
☐ TSO/AP-TC ARTICLE

is in conformity with the applicable installation drawing(s) listed above
and that necessary ground tests have been carried out.
[Please check (✓) the applicable box.]

TC INSPECTION

- ☒ ACCEPTABLE
- ☐ UNACCEPTABLE

Additional Information:

Remarks:

Signature:

Signature:

[Signature]

MOORE M STEWART

CONFORMITY INSPECTION RECORD

Applicant	Aeronautical Product				Title of Change
AERO Design Ltd	Make Bell	Model 212, 412, 205A-1, 205B	Serial No.	Registration	Bracket
Drawing No.	Applicant's Inspector		T.C. Inspection		
	Signature	Date	Signature	Date	Findings
80120 RD	<i>[Signature]</i>	<i>June 18/08</i>			

APPLICANT'S ATTESTATION

I hereby confirm that the prototype installation for the subject

- ☒ MODIFICATION,
☐ REPAIR,
☐ TSO/AP-TC ARTICLE

is in conformity with the applicable installation drawing(s) listed above and that necessary ground tests have been carried out.
 [Please check (✓) the applicable box.]

Additional Information:

Signature: *[Signature]*

TC INSPECTION

- ☒ ACCEPTABLE
☐ UNACCEPTABLE

Remarks:

Signature: *[Signature]* *M. Stewart*

ALBERTA

Chrome & Grinding

INDUSTRIAL CHROME

Ziad El-Bittar
Manager

4726 1st Street SE
Calgary, Alberta T2G 2L3
www.albertachrome.com

Tel: 403.243.6036
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Calgary AB

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Alberta Chrome & Grinding (2001) Ltd

Contact this company

4726 1 St Se
Calgary AB, T2G 2L3

Phone #: 403-243-6036
Fax #: 403-243-2746

Key contact: Heinz Zabbe

Approximately eight employees work at this location
Sales: \$1 - \$5 Million

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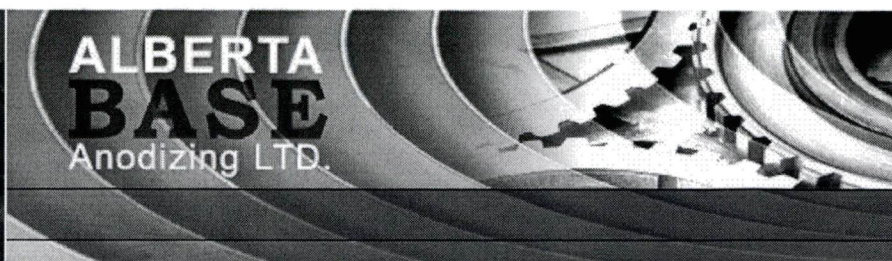
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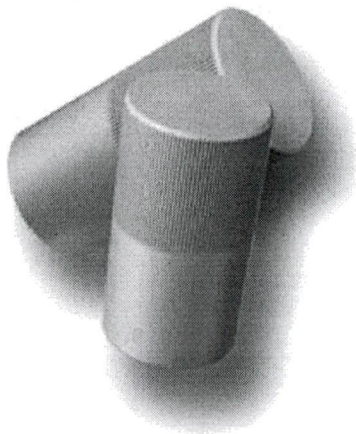
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5 January 2009

Transport Canada
Aircraft Certification Division
800-1601 Airport Road
Calgary, Alberta
T2E 6Z8

Attn: Greg Oucharek

Your File : C-08-0641

Our File : 808

Re: Addressed issues detailed in email from Greg Oucharek to Ted Bergoin sent June 19, 2008.

Greg,

Please reference your email, To: Ted Bergoin, Sent: June 19, 2008, Subject: RE: 212/205 Rappel Provision and Cargo Deployment Arm *** Conformity Inspection / Dwg Review ***.

1. The issue regarding the finish notes being too general has been addressed on all applicable drawings. The newly revised drawings shall indicate that the finish must be completed to an Aero Design Standard.
2. The issue regarding grain direction has been reviewed. For most parts the design allowables for L and LT are the same for the materials specified. The engineering reports have been reviewed for parts which the material design allowables are different for L and LT. All margins of safety have remained positive.
3. The issue regarding fits and tolerances has been checked and then addressed where required.
4. The issue regarding dimensioning has been checked and then addressed where required.
5. The issue regarding surface roughness has been considered. The installation of the Rappel Provision and Cargo Deployment Arm contains no performance parts. Therefore defining surface roughness is not applicable.

Regards,

Richard Rathwell

NOT MEASUREMENT
SENSITIVE
MIL-A-8625F
10 September 1993
SUPERSEDING
MIL-A-8625E
25 April 1988

MILITARY SPECIFICATION

ANODIC COATINGS FOR ALUMINUM AND ALUMINUM ALLOYS

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the requirements for six types and two classes of electrolytically formed anodic coatings on aluminum and aluminum alloys for non-architectural applications (see 6.1).

1.2 Classification. The anodic coating Types and Classes covered by this specification are as specified herein (see 6.2 and 6.21):

1.2.1 Types

- Type I - Chromic acid anodizing, conventional coatings produced from chromic acid bath (see 3.4.1)
- Type IB - Chromic acid anodizing, low voltage process, $22 \pm 2V$, (see 3.4.1)
- Type IC - Non-chromic acid anodizing, for use as a non-chromate alternative for Type I and IB coatings (see 3.4.1 and 6.1.2)
- Type II - Sulfuric acid anodizing, conventional coatings produced from sulfuric acid bath (see 3.4.2)
- Type IIB - Thin sulfuric acid anodizing, for use as a non-chromate alternative for Type I and IB coatings (see 3.4.2 and 6.1.2)
- Type III - Hard Anodic Coatings (see 3.4.3)

1.2.2 Classes

- Class 1 - Non-dyed (see 3.5.)
- Class 2 - Dyed (see 3.6.)

Dye no impact on hardness

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commanding Officer, Naval Air Warfare Center Aircraft Division Lakehurst, Code SR3, Lakehurst, NJ 08733-5100, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

AREA MFFP

DISTRIBUTION STATEMENT A: Approved for public release; distribution is unlimited.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

SPECIFICATIONS

MILITARY

- MIL-P-23377 - Primer Coating, Epoxy-Polyamide, Chemical and Solvent Resistant
- MIL-C-81706 - Chemical Conversion Materials for Coating Aluminum and Aluminum Alloys
- MIL-P-85582 - Primer Coatings: Epoxy, Waterborne

FEDERAL

- QQ-A-250/4 - Aluminum Alloy 2024, Plate and Sheet

STANDARDS

FEDERAL

- FED-STD-141 - Paint, Varnish, Lacquer, and Related Materials: Methods For Sampling and Testing
- FED-STD-151 - Metals; Test Methods

MILITARY

- MIL-STD-105 - Sampling Procedures and Tables For Inspection By Attribute

(Unless otherwise indicated, copies of federal and military specifications and standards are available from DODSSP-Customer Service, Standardization Documents Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM B 117 - Method of Salt Spray (Fog) Testing
- ANSI/ASTM B 137 - Weight of Coating on Anodically Coated Aluminum, Measurement of
- ASTM B 244 - Thickness of Anodic Coatings on Aluminum and of Other Nonconductive Coatings on Nonmagnetic Basis Metals with Eddy Current Instruments, Measurement of
- ASTM D 822 - Light and Water Exposure Apparatus (Carbon-Arc Type) for Testing Paint, Varnish, Lacquer and Related Products, Standard Practice for Operating

- ASTM D 2244 - Color Differences of Opaque Materials, Instrumental Evaluation of
- ASTM G 23 - Standard Practice for Operating Light Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Non-metallic Materials
- ASTM G 26 - Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Non-metallic materials

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Materials. The materials used shall be such as to produce coatings which meet the requirements of this specification.

3.1.1 Base metal. The base metal shall be free from surface defects, caused by machining, cutting, scratching, polishing, buffing, roughening, bending, stretching, deforming, rolling, sandblasting, vaporblasting, etching, heat treatment condition, alloy chemistry imbalance and inclusions, that will cause coated test panels or parts to fail any of the requirements of this specification. The base metal shall be subjected to cleaning, etching, anodizing and sealing procedures as necessary to yield coatings meeting all requirements of this specification.

3.2 Equipment and processes. The equipment and processes employed shall be such as to produce coatings which meet the requirements of this specification. Unless otherwise specified in the contract, purchase order or applicable drawing (see 6.2), process operating conditions shall be at the option of the supplier.

3.3 General.

3.3.1 Anodizing of parts and assemblies.

3.3.1.1 Anodizing of parts. Unless otherwise specified in the contract, purchase order or applicable drawing (see 6.2), parts shall be anodized after all heat treatment, machining, welding, forming and perforating have been completed.

3.3.1.2 Anodizing of assemblies. Unless otherwise specified in the contract, purchase order or applicable drawing, anodic coatings shall not be applied to assemblies which will entrap the electrolyte in joints or recesses (components shall be anodized separately prior to assembly). When anodizing of assemblies is authorized by the contract, purchase order or applicable drawing, the processing method used shall not result in subsequent damage to the assembly from electrolyte entrapment (Type I or IA coatings shall be used unless another coating Type is specified). Assemblies which contain non-aluminum parts such as steel, brass or organic substances, which would be attacked by pretreatment or anodizing solutions or would prevent uniform formation of the anodic coating, shall not be anodized as assemblies, unless the non-aluminum surfaces are masked or electrically insulated in a manner which produces anodic coatings meeting the requirements of this specification.

3.3.1.2 Anodizing of complex shapes. When anodizing complex shapes which will entrap the electrolyte in recesses, the processing method used shall not result in subsequent damage to the part from electrolyte entrapment (Type I or IA coatings shall be used unless another coating Type is specified).

3.3.2 Handling and cleaning. Parts shall be so handled during all pretreatments, anodizing and post treatments that mechanical damage or contamination will be avoided. Parts shall be free of all foreign substances, oxides and soils, such as greases, oil, paint and welding flux. Parts shall have oxide and other interfering films removed by the use of proper cleaning procedures so as to be clean and have water break free surfaces. Abrasives containing iron, such as steel wool, iron oxide rouge and steel wire, which may become embedded in the metal and accelerate corrosion of aluminum and aluminum alloys, are prohibited as a means of mechanical cleaning, prior to anodizing. If special cleaning requirements are required they shall be specified in the contract or purchase order (see 6.2).

3.3.3 Reflective surfaces. When specified in the contract or purchase order (see 6.2), parts fabricated to produce a highly reflective surface shall be chemically or electrochemically brightened, prior to anodic coating (see 6.9).

3.3.4 Touch up (mechanical damage and contact marks). Unless otherwise specified (see 6.2), mechanically damaged areas from which the anodic coating has been removed without damage to the part may be touched up using chemical conversion materials approved on QPL-81706 for Class IA coatings and the applicable method of application. Touch up shall apply only to inadvertent mechanical damage such as scratch marks. For Type III coatings, touch up shall only be allowed in areas which will not be subjected to abrasion (see 6.1.1). The mechanically damaged area(s) shall not exceed 5 percent of the total anodized area of the item or touch up shall not be permitted. When specified in the contract or purchase order (see 6.2), contact marks shall be touched up using the above method required for mechanical damage.

3.4 Coatings. Conventional anodic coatings as specified in the contract, purchase order or applicable drawings (see 6.2), shall be prepared by any process or operation to produce the specified coating on aluminum and aluminum alloys.

3.4.1 Type I, IB, and IC coatings. Type I and IB coatings shall be the result of treating aluminum and aluminum alloys electrolytically in a bath containing chromic acid to produce a uniform anodic coating on the metal surface. Type IC coatings shall be the result of treating aluminum and aluminum alloys electrolytically in a bath containing mineral or mixed mineral/organic acids (non-chromic acid) to produce a uniform anodic coating on the metal surface. Unless otherwise specified in the contract, purchase order or applicable drawing, Type I coatings shall not be applied to aluminum alloys with a nominal copper content in excess of 5.0 percent; nominal silicon contents in excess of 7.0 percent; or when the total allowable contents of nominal alloying elements exceed 7.5 percent. Heat treatable alloys which are to receive a Type I, IB, or IC coating shall be in the required temper obtained by heat treatment, such as -T4, -T6, or T73, prior to anodizing.

3.4.1.1 Type IC coatings. Type IC coatings provide a non-chromate alternative to Type I and IB coatings. Unless approved by the procuring activity, substitution of a Type IC coating where Type I or IB is specified shall be prohibited.

3.4.2 Type II and IIB coatings. Type II and IIB coatings shall be the result of treating aluminum and aluminum alloys electrolytically in a bath containing sulfuric acid to produce a uniform anodic coating on the metal surface. Heat treatable alloys shall be in the required temper obtained by heat treatment, such as -T4, -T6, or T73, prior to anodizing.

3.4.2.1 Type IIB coatings. Type IIB coatings provide a non-chromate alternative to Type I and IB coatings. Unless approved by the procuring activity, substitution of a Type IIB coating where Type I or IB is specified shall be prohibited.

3.4.3 Type III coatings. Type III coatings shall be the result of treating aluminum and aluminum alloys electrolytically to produce a uniform anodic coating on the metal surface. Type III coatings shall be prepared by any process operation to produce a heavy dense coating of specified thickness on aluminum alloys (see 3.7.2.1). Unless otherwise specified in the contract, purchase order or applicable drawing, Type III coatings shall not be applied to aluminum alloys with a nominal copper content in excess of 5 percent or a nominal silicon content in excess of 8.0 percent. Alloys with a nominal silicon content higher than 8.0 percent may be anodized subject to approval of the procuring activity. Heat treatable alloys shall be in a temper obtained by heat treatment, such as -T4, -T6, or T73, prior to anodizing.

3.5 Class 1. When class 1 is specified in the contract or purchase order, (see 6.2), the anodic coating shall not be dyed or pigmented. Any natural coloration resulting from anodic treatment with the various alloy compositions shall not be considered coloration. The characteristic color imparted by the sealing process shall also be considered as non-dyed.

3.6 Class 2. When class 2 is specified in the contract or purchase order (see 6.2), the anodic coating shall be uniformly dyed or pigmented by exposure to a solution of a suitable type dye or stain. The color on wrought alloys shall be uniform. Cast alloys may exhibit dye bleed-out or lack of color (or color uniformity) associated with the inherent porosity of the casting. The dyes and pigments used shall not be damaging to the anodic coatings.

3.6.1 Dye color. When dyed or pigmented coatings are required, the color and color uniformity requirements shall be as specified on the contract, purchase order or applicable drawing (see 6.2).

3.6.1.1 Casting alloys. Dyed casting alloys may show a slight lack of color uniformity. The degree of non-uniformity that is acceptable shall be established by the procuring activity (see 6.2).

3.7 Detail requirements.

3.7.1 Types I, IB, IC, II, and IIB coatings.

3.7.1.1 Weight of coating. Prior to dyeing or sealing, Type I, IB, IC, II, and IIB coatings shall meet the coating weight requirements of Table I when tested in accordance with 4.5.2 (see 6.10.6).

TABLE I. Types I, IB, IC, II, and IIB unsealed anodic coating weights.

Coating Type	Coating Weight (mg/ft ²)
I and IB	200 minimum
IC 1/	200 minimum - 700 maximum
II	1000 minimum
IIB	200 minimum - 1000 maximum

1/ - Coating weights over 700 mg/ft² may be used if specified in the contract or purchase order (see 6.1.2 and 6.2).

3.7.1.2 Corrosion resistance. After exposure to the salt spray test specified in 4.5.3, specimens shall be visually examined to determine that all of the following conditions are met:

a. Test specimens shall show no more than a total of 15 isolated pits (see 6.19), none larger than 0.031 inch in diameter, in a total of 150 square inches of test area grouped from five or more test pieces. Areas within 0.062 inch from identification markings, edges and electrode contact marks remaining after processing shall be excluded.

b. Test specimens shall show no more than 5 isolated pits, none larger than 0.031 inch in diameter, in a total of 30 square inches from one or more test pieces. Areas within 0.062 inch from identification markings, edges and electrode contact marks remaining after processing shall be excluded.

c. In addition to the requirements in (a) and (b) above, Type I and IB test specimens shall not exhibit patchy dark gray areas (spots, streaks, or marks).

3.7.1.3 Light fastness resistance. Class 2, dyed anodic coatings, shall show no more fading or discoloration than would be equivalent to a Delta (E) value of 3 when subjected to the light fastness resistance test (see 4.5.4), unless otherwise specified in the contract or purchase order (see 6.2). Light fastness resistance shall be determined only when specified in the contract, purchase order or applicable drawing (see 6.2).

3.7.1.4 Paint adhesion. When tested in accordance with 4.5.6, no intercoat separation shall occur between the paint system and the anodic coating or between the anodic coating and the base metal. Paint adhesion shall be determined only when specified in the contract, purchase order or applicable drawing (see 6.2).

3.7.2 Type III coatings.

3.7.2.1 Thickness of coating. Unless otherwise specified in the contract, purchase order, or applicable drawing (see 6.2), the nominal thickness of the coating shall be 0.002 inch (2 mils) (see 6.16, 6.17 and 6.10 through 6.10.5). Unless otherwise specified, the thickness of the coating shall not vary by more than ± 20 percent for coatings up to 0.002 inches thick (2 mils) when tested in accordance with 4.5.1. Coatings over 0.002 inches (2 mils) shall not vary by more than ± 0.0004 inches (0.4 mils) in thickness. A typical Type III coating thickness range is shown in Table IV.

3.7.2.1.1 Weight of coating. The coating weight may be determined in lieu of the coating thickness (see 3.7.2.1), at the option of the procuring activity. Unsealed Type III coatings shall have a minimum coating weight of 4320 milligrams per square foot for every 0.001 inch of coating when tested in accordance with 4.5.2 (see 6.2).

3.7.2.2 Abrasion resistance. When tested in accordance with 4.5.5, unsealed Type III coatings shall provide a hard abrasion resistant finish as specified herein (see 6.17). The anodic coating shall have a maximum wear index of 3.5 mg/1000 cycles on aluminum alloys having a copper content of 2 percent or higher (see 6.13). The wear index for all other alloys shall not exceed 1.5 mg/1000 cycles.

3.8 Sealing.

3.8.1 Types I, IB, IC, II, and IIB. All Types I, IB, IC, II, and IIB anodic coatings shall be completely sealed, unless otherwise specified in the contract, purchase order or applicable drawing (see 6.2). They shall be sealed in accordance with 3.8.1.1 or 3.8.1.2 as applicable. If wetting agents are used they shall be of the non-ionic type.

3.8.1.1 Class 1. When class 1 is specified, sealing shall be accomplished by immersion in a sealing medium such as a 5 percent aqueous solution of sodium or potassium dichromate (pH 5.0 to 6.0) for 15 minutes at 90°C to 100°C (194°F to 212°F), in boiling deionized water, cobalt or nickel acetate, or other suitable chemical solutions (see 6.15).

3.8.1.2 Class 2. When class 2 is specified, sealing shall be accomplished after dyeing by immersion in a sealing medium, such as a hot aqueous solution containing 0.5 percent nickel or cobalt acetate (pH 5.5 to 5.8), boiling deionized water, duplex sealing with hot aqueous solutions of nickel acetate and sodium dichromate (see 6.11), or other suitable chemical solutions.

3.8.2 Type III. Type III coatings shall not be sealed where the main function of application is to obtain the maximum degree of abrasion or wear resistance. Where Type III coatings are used for exterior non-maintained applications requiring corrosion resistance but permitting reduced abrasion resistance, the contract or purchase order shall specify that sealing is required. Sealing for such Type III coatings shall be accomplished by immersion in a medium, such as boiling deionized water, in a hot aqueous 5 percent sodium dichromate solution, in a hot aqueous solution containing nickel or cobalt acetate or other suitable chemical solutions (see 6.2). When Type III coatings are provided unsealed, parts shall be thoroughly rinsed in cold, clean water and dried after anodizing.

3.9 Dimensions of coated articles. Articles or parts shall comply with the dimensional requirements of the applicable drawings after application of the anodic coating (see 6.10.1). (For interference in close fits of parts or assemblies see 6.10.5).

3.10 Toxicity. The coatings and electrical/chemical processes used to develop these anodic coatings shall have no adverse effect on the health of personnel when used for their intended purposes. Questions pertinent to this effect shall be referred by the contracting activity to the appropriate departmental medical service who will act as an advisor to the contracting agency.

3.11 Painting/coating. Painting/coating operations shall be performed as soon as practical after the anodizing process on clean coatings. If parts require storage prior to painting/coating, they shall be stored in a manner that will avoid contamination. If the parts become contaminated, they shall be cleaned in a manner that will not be detrimental to the anodic coating or the base metal (see 6.3).

3.12 Dyeing or coloring. Anodic coatings shall not be allowed to dry before dyeing or coloring. Items to be dyed or colored should be preferably coated by the Type II anodizing treatment (see 6.12). Dyed or colored coatings shall not be allowed to remain in rinse waters for more than 5 minutes before sealing.

3.13 Workmanship. Except for touch up areas in accordance with 3.3.4 and as noted below, the applied anodic coating shall be continuous, smooth, adherent, uniform in appearance, free from powdery areas, loose films, breaks, scratches and other defects which will reduce the serviceability of anodized parts or assemblies. Differences in anodic coating appearance resulting from inherent base metal differences in a component such as the presence of welds, components containing cast and machined surfaces, and differences in grain size within a forging shall not be cause to reject the anodic coating unless otherwise specified in the contract or purchase order (see 6.2). Slight discoloration from dripping or rundown of the sealing solution from designed crevices in a component shall be allowed.

3.13.1 Contact marks. The size and number of contact marks shall be at a minimum consistent with good practice (see 6.14). If a specific location for contact marks is desired, the location shall be specified on the contract or purchase order (see 6.2).

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items must meet all requirements of Section 3. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.2 Classification of inspection. The inspection requirements specified herein are classified as follows:

- a. Process control inspection (see 4.3).
- b. Quality conformance inspection (see 4.4).

4.3 Process control inspection.

4.3.1 Process control document (PCD). The anodizer shall develop, maintain, and adhere to a PCD describing the anodizing process and procedures used to meet the requirements of this specification. As a minimum, the PCD shall describe the following:

- All steps in the processing sequence.
- Ranges for immersion time and temperature for each step in the process.
- Chemical constituents used and allowable solution control ranges to be used for solution analysis (see 4.3.2) for each step in the process.
- Ranges for temperature, current density and anodizing time (or voltage ramps and hold times) as applied to individual alloys or alloy series.

4.3.2 Solution analysis. Solution analysis shall be performed on all the processing solutions in the anodizing line to determine if the solution controls are within the acceptable ranges established in the PCD (see 4.3.1). Solution analysis shall be performed at least once every two weeks unless otherwise specified by the procuring activity. The processor shall maintain a record of the history of each processing bath, showing all chemicals or treatment solutions added to the baths and the results of all chemical analysis performed. Upon request of the procuring activity, such records, as well as reports of the test results, shall be made available. These records shall be maintained for not less than one year after completion of the contract or purchase order.

4.3.3 Process control tests. To assure continuous control of the process, specimens shall be tested in accordance with Table II. Process control tests are conducted to determine conformance of the anodic coatings with the requirements of this specification and are acceptable as evidence of the properties being obtained with the equipment and procedures employed.

4.3.3.1 Frequency of the process control tests. Process control tests shall be conducted at least once every month. In addition, the intervals between each monthly test shall not exceed 35 days. If production in accordance with this specification is not performed for a period of one month or longer, process control tests shall be conducted at the start of production.

TABLE II. Process control tests.

Test	Applicable Type	Number of specimens to be tested	Paragraph		
			Specimen Preparation	Requirement	Test Method
Coating weight	I, IB, IC, II, IIB III 1/	3	4.3.3.2.1	3.7.1.1	4.5.2
Coating thickness	III 1/	3	4.3.3.2.2	3.7.2.1	4.5.1
Corrosion resistance	I, IB, IC, II, IIB	5 (minimum)	4.3.3.2.3	3.7.1.2	4.5.3
Light fastness	I, IB, IC, II, IIB Class 2 only	3	4.3.3.2.3	3.7.1.3	4.5.4
Abrasion resistance	III	2	4.3.3.2.4	3.7.2.2	4.5.5

1/ For Type III coatings, the coating weight may be chosen in lieu of the coating thickness at the option of the procuring activity (see 3.7.2.1.1).

4.3.3.2 Process control test specimens. Production parts shall be used for process control inspection provided they can be adapted to the applicable test. If the production parts can not be adapted to a particular test, test panels shall be used. At the option of the supplier, test panels shall be composed of either 2024-T3 per QQ-A-250/4 or the alloy representing the largest percent of work anodized during the monthly process control period. Whenever possible, the specimen panels shall be anodized with an actual production run. Additional details for the specimen panels shall be as specified in 4.3.3.2.1 through 4.3.3.2.4.

4.3.3.2.1 Test specimens for coating weight. Coating weight shall be determined on undyed and unsealed production parts or specimen panels (see 4.3.3.2). When specimen panels are used, they shall have a minimum width of 3 inches, a minimum length of 3 inches, and a minimum nominal thickness of 0.032 inches.

4.3.3.2.2 Test specimens for coating thickness. Coating thickness shall be determined on Type III production parts or specimen panels (see 4.3.3.2). When specimen panels are used, they shall have a minimum width of 3 inches, a minimum length of 3 inches, and a minimum nominal thickness of 0.032 inches.

4.3.3.2.3 Test specimens for corrosion and light fastness resistance. Corrosion resistance shall be determined on dyed (Class 2 only) and sealed production parts or specimen panels (see 4.3.3.2). Light fastness testing is performed only on dyed (Class 2) coatings and only when specified (see 6.2). When specimen panels are used, they shall have a minimum width of 3 inches, a minimum length of 10 inches, and a minimum nominal thickness of 0.032 inches.

4.3.3.2.4 Test specimens for abrasion resistance. Abrasion resistance shall be determined on Type III production parts or specimen panels (see 4.3.3.2). When specimen panels are used, they shall have a width of 4 inches, a length of 4 inches, and a minimum nominal thickness of 0.063 inches.

4.3.4 Failure. Failure to conform to any of the process control requirements specified in Table II shall result in immediate halt of production. The reason for failure shall be determined and corrected before production resumes. All traceable work from the time the failed process control specimens were anodized to the time when production was halted shall be rejected unless otherwise specified by the contracting officer. Traceable work shall be defined as all work in which the location is known. Process control testing shall be performed at the start of production.

4.4 Quality conformance (ie. lot acceptance) inspection. Quality conformance inspection shall consist of visual (see 4.4.2.1) and dimensional (see 4.4.2.2) examinations (see 6.2.1). When specified in the contract or purchase order (see 6.2), quality conformance inspection shall also include paint adhesion testing in accordance with 4.5.6.

4.4.1 Lot. A lot shall consist of all items of the same part number anodized in the same tank using the same process and of the same coating type and class offered for acceptance at one time. In addition, the lot size shall not exceed the number of items processed in one shift.

4.4.2 Sampling for visual and dimensional examinations. Samples for visual and dimensional examinations (see 4.4.2.1 and 4.4.2.2) shall be selected from each lot of anodized parts in accordance with the provisions of MIL-STD-105, Inspection Level II. The acceptance criteria shall be as specified in the contract or purchase order (see 6.2 and 6.20). If no acceptance criteria is specified, the criteria given in 6.20 shall be used.

4.4.2.1 Visual examination. Samples selected in accordance with 4.4.2 shall be inspected and visually examined for compliance with 3.13 after anodizing, sealing and dyeing (if applicable).

4.4.2.2 Dimensional examination. Samples, selected in accordance with 4.4.2, shall be dimensionally inspected for compliance with 3.9, unless otherwise specified by the procuring activity (see 6.10.5).

4.4.3 Sampling for paint adhesion testing. When the paint adhesion test is specified (see 4.4), two test panels shall be tested in accordance with 4.5.6 to determine conformance to 3.7.1.4. The test panels shall be 3 inches in width by 10 inches in length with a minimum nominal thickness of 0.032 inches. Unless otherwise specified, the test panels shall be composed of either 2024-T3 per QQ-A-250/4 or the predominant alloy in the lot from which the paint adhesion test is required to be performed. Unless another paint system is specified (see 6.2), the paint system in 4.4.3.1 shall be applied to the anodized panels.

4.4.3.1 Preparation of paint adhesion specimens. Specimen panels (see 4.4.3) shall be finished with one coat of an epoxy-polyamide primer conforming to either MIL-P-23377 (Class 1 or 2) or MIL-P-85582. In either case the primer shall be applied to a dry film thickness of 0.0006 to 0.0009 inch (0.6 to 0.9 mil) and dried in accordance with the applicable primer specification before testing in accordance with 4.5.6.

4.4.4 Failure. Failure to conform to any of the quality conformance requirements shall result in rejection of the represented lot.

4.5 Test methods.

4.5.1 Anodic coating thickness. Test specimens prepared in accordance with 4.3.3.2.2, shall be tested for anodic coating thickness in accordance with ASTM B 244, Method 520 or Method 520.1 of FED-STD-151 to determine conformance to the requirements of 3.7.2.1. If either ASTM B 244 or Method 520 of FED-STD-151 is used, the thickness shall be computed as the average of not less than eight measurements. In case of dispute, anodic coating thickness shall be determined by measurement of a perpendicular cross section of the anodized specimen using a metallographic microscope with a calibrated eyepiece.

4.5.2 Anodic coating weight. Test specimens prepared in accordance with 4.3.3.2.1 shall be tested for anodic coating weight either in accordance with ANSI/ASTM B 137, or the method specified in 4.5.2.1. Type I, IB, IC, II, and IIB coatings shall be tested for conformance with the requirements of 3.7.1.1. If the procuring activity chooses to have coating weight tested in lieu of the coating thickness for Type III hard anodized coatings, it shall be tested for conformance with 3.7.2.1.1.

4.5.2.1 Method. Anodic coating weight determinations shall be accomplished in the following manner:

a. Test specimens shall be weighed immediately after anodizing, prior to dyeing or sealing. An analytical balance or other instrument sensitive to at least 10 percent of the net Anodic coating weight on test specimen shall be used. Specimens shall be cleaned and dried for a minimum of 30 minutes at $93^{\circ} \pm 6^{\circ}\text{C}$ ($200^{\circ} \pm 10^{\circ}\text{F}$) and allowed to cool to room temperature before weighing.

b. Immediately after weighing, the test specimens shall be stripped by immersion in a phosphoric-chromic acid solution for a minimum of 5 minutes, (not to exceed 6 minutes), at $100^{\circ} \pm 6^{\circ}\text{C}$ ($212^{\circ} \pm 10^{\circ}\text{F}$). The solution shall consist of the following:

Phosphoric acid, 85 percent	35 milliliters
Chromic acid (CrO_3)	20 grams
Water to make	1,000 milliliters

c. The test specimens shall be removed from the solution, washed in distilled water, dried, and weighed. The 5-minute exposure shall be repeated until the coating is completely removed, which is indicated by the specimen's weight remaining constant. The stripping solution shall be discarded after 1-liter of the solution has dissolved 5 grams of the anodic coating.

d. After final weighing, the total surface area of the test specimen shall be accurately determined.

e. The unit film weight shall be determined by subtracting the weight in milligrams of the stripped specimen from its weight in milligrams prior to stripping and dividing by the surface area expressed in square feet.

4.5.3 Corrosion resistance.

4.5.3.1 Method. Test specimens, prepared in accordance with 4.3.3.2.3, shall be washed in distilled or deionized water, dried with a soft cloth and then subjected to a 5 percent salt spray test in accordance with ASTM B 117, except that the significant surface shall be inclined 6 degrees from the vertical. Specimens shall be exposed for 336 hours. After exposure, specimens shall be examined to determine compliance with 3.7.1.2.

4.5.4 Light fastness resistance (Class 2 only). Test specimens, prepared in accordance with 4.3.3.2.3, shall be tested for light fastness resistance by exposure to ultraviolet radiation in accordance with either ASTM G 23, ASTM D 822 or ASTM G 26, for a period of 200 hours, except that the specimens will be exposed continuously to light without water spray. After exposure, specimens shall be compared with duplicate specimens not exposed to a light source for the same period of time to determine the Delta (E) value in accordance with ASTM D 2244. The Delta (E) value shall be used to determine conformance with 3.7.1.3.

4.5.5 Abrasion resistance. Test specimens, prepared in accordance with 4.3.3.2.4, shall be tested in accordance with Method 6192.1 of FED-STD-141 using CS-17 wheels with a 1000 gram load. The wheels shall revolve on the anodic coating at a speed of 70 revolutions per minute (RPM) for 10,000 cycles. The abrasion wheels shall be refaced at least once every 10,000 cycles. The wear index shall be determined after the 10,000 cycle period by dividing the weight loss by 10. The wear index shall meet the requirements of 3.7.2.2.

4.5.6 Paint adhesion test. When specified (see 4.4), specimen panels prepared in accordance with 4.4.3 shall be tested for wet tape adhesion. The test shall be conducted as described in method 6301 of FED-STD-141 to determine conformance with paragraph 3.7.1.4.

5. PACKAGING (Not applicable to this specification)

6. NOTES (This section contains information of a general or explanatory nature that may be helpful but is not mandatory)

6.1 Intended use. The coatings covered in this document are intended to yipvide corrosion resistance, improved paint adhesion and abrasion resistance as specified in 6.1.1 through 6.1.3. This document is not intended to sufficiently cover anodic coatings for use in structural adhesive bonding.

6.1.1 Types I, IB and II. The conventional Types I, IB and II anodic coatings are intended to improve surface corrosion protection under severe service conditions or as a base for paint systems. Anodic coatings can be colored with a large variety of dyes and pigments. Types I, IB and II coatings provide better corrosion protection at higher cost than the chemical conversion systems. Repair of mechanically damaged areas by the use of materials conforming to MIL-C-81706 (see 3.3.4) will not restore abrasion resistance but will provide an effective means of reestablishing corrosion resistance. Where anodic coatings are required on fatigue critical components, Type I and IB coatings (see 6.1.2) are used due to the thinness of the coating (see 6.10.7).

6.1.2 Type IC and IIB. Type IC and IIB coatings provide non-chromate alternatives to Type I and IB coatings where corrosion resistance, paint adhesion, and fatigue resistance is required. Please note that Type IC or IIB may not serve as suitable replacements when the effects of electrolyte entrapment is the primary concern (see 3.3.1.2 and 3.3.1.3). Maximum Type IC and Type IIB coating weights of 700 mg/ft² and 1000 mg/ft², respectively, are specified in Table I for fatigue purposes (see 6.10.7). If higher Type IC coating weights are permissible for the intended use, it should be specified in the contract or purchase order (see 6.2). If higher Type IIB coating weights are permissible for the intended use, Type II should be specified.

6.1.3 Type III. Type III coatings are intended to provide wear and abrasion resistant surfaces with improved corrosion protection due to greater thickness and weight than the conventional anodic coatings. Sealing of Type III coatings is not recommended unless corrosion resistance is also a factor. Wear resistance is reduced by sealing. Anodic coatings form an excellent base for most types of paint systems, adhesives and dry film lubricants. Hard coatings may reduce fatigue strength. These factors should be considered in proposed use of parts subjected to cyclic loads. Generally, these hard coatings should not be used on parts or portions of parts which normally during rework would require restoring of dimensional tolerances because of wear of hard coated surfaces.

6.1.3.1 Applications. Type III coatings are used in such applications as valves, sliding parts, hinge mechanisms, cams, gears, swivel joints, pistons, rocket nozzles, insulation plates, blast shields, etc.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number and date of this specification.
- b. Type of anodic coating (see 1.2.1).
- c. Class of anodic coating (see 1.2.2).
- d. Special process operating conditions, if applicable (see 3.2).
- e. Special cleaning and fabrication requirements (see 3.3.1, 3.3.2, and 3.3.3).
- f. If coating weight for Type IC can exceed the maximum specified in Table I.
- g. Color and uniformity of Class 2 coatings, if applicable (see 3.6.1 and 3.12).
- h. Degree of non-uniformity of dyed casting alloys (see 3.6.1.1).
- i. Light fastness resistance, if applicable, and a Delta E value if different than 3 (see 3.7.1.3).
- j. Type III coating thickness, if applicable (see 3.7.2.1).
- k. Coating weight for thickness, Type III, if substituted (see 3.7.2.1.1).
- l. Special sealing requirements (see 3.8).
- m. When applicable, the allowable difference in anodic coating appearance resulting from inherent base metal differences (see 3.13).
- n. Provide the specific location of contact marks if important to the function of the part (see 3.13.1 and 6.14).
- o. Acceptance criteria for quality conformance inspections (see 4.4.2 and 6.20).
- p. If paint adhesion testing is required for quality conformance testing (see 4.4) and the required paint system (if different than that in 4.4.3.1).

6.2.1 Consideration of data requirements. The following data requirements should be considered when this specification is applied on a contract. The applicable Data Item Description (DID) should be reviewed in conjunction with the specific acquisition to ensure that only essential data are requested/provided and that the DID is tailored to reflect the requirements of the specific acquisition. To ensure correct contractual application of the data requirements, a Contract Data Requirements List (DD Form 1423) must be prepared to obtain the data, except where DOD FAR Supplement 27-4.75-1 exempts the requirement for a DD Form 1423.

<u>Reference Para.</u>	<u>DID Number</u>	<u>DID Title</u>	<u>Suggested Tailoring</u>
4.4	DI-NDTI-80809A	TEST/INSPECTION REPORTS	10.2.7.1

The above DID was cleared as of the date of this specification. The current issue of DOD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be researched to ensure that only current, cleared DID's are cited on the DD Form 1423.

6.2.2 Exceptions to drawings for types I, IB, IC, II, and IIB coatings. When the anodic coating type is not specified on the drawing, Type I, IB, IC, II, or IIB may be furnished within the limits of this specification, at the option of the contractor. When the coating class is not specified on the drawing, either Class 1 or Class 2 may be supplied within the limits of this specification, at the option of the contractor.

6.3 Painting/coating. When anodic coatings are required to be painted/coated, the parts should be dried and painted as promptly as possible, during which time, exposure to contamination should be kept to a minimum. Prior to painting or coating anodized parts, wiping, buffing or mechanical operations should be kept to a minimum. This may damage the less dense outside layer of the anodic coating making it susceptible to subsequent adhesion failures. Sealing processes can have a significant effect on adhesion of primers and other polymeric materials to the anodized surface as well as the cohesive strength of the anodized layer. If these factors are important to the application, such as subsequent painting operations, specific details for (or the omission of) the sealing process should be specified in the contract or purchase order.

6.4 Electrolytic action. Severe attack by the electrolyte on castings or welds may be occasioned either by unsound castings, improper welding practice, a difference in composition between the weld and the base metal or, particularly in the case of the sulfuric acid process, the retention of the solution in cracks, crevices, or irregular surfaces. Severe attack by the electrolyte may also be caused by contaminants in the electrolyte, particularly chlorides or by improper racking of the parts.

6.5 Anodizing rate. Aluminum and aluminum alloys may be conveniently grouped by anodizing rate, especially in the case of the chromic acid process (Type I) for conventional coatings. However, either the chromic (Type I) or the sulfuric acid process (Type II) will anodize mixed loads satisfactorily, depending upon local processing preference. Suppliers are cautioned that, especially in the sulfuric acid process, the anodizing time will have to be sufficiently long to assure that the slower anodizing alloys have at least a minimum coating thickness. In some cases, this may result in improper coatings on the fast anodizing alloys.

6.6 Color match. FED-STD-595 may be used as a guide for specifying color of anodic coatings. The color standards in FED-STD-595 are intended for paint finishes and should be used for approximate comparison only with the anodic coatings (see 6.2).

6.7 Lapping. The Type III anodic coatings generally have increased surface roughness as well as having the property of being less dense on the top surface than in the core of the coating toward the base metal. Such coatings may be processed oversized and then lapped or honed down to the final desired dimension.

6.8 Coating baths. For information, it should be noted that processes providing other coating electrolytes for the conventional coatings may be aqueous solutions containing oxalic acid, boric acid plus ammonium borate and nitrides. There are proprietary processes requiring coating electrolytes, other than sulfuric acid, for the Type III coatings; for example, the various

Alumilites, the Martin Hard Coat, the Sanford, the Hardas and others. One of the Alumilite processes requires an aqueous solution containing both sulfuric and oxalic acids for the bath. Other baths used less frequently and for special purposes employ sulfosalicylic, sulfamic or sulfophthalic acid solutions.

6.9 Chemical brightening and polishing. Chemical brightening can be beneficial by improving the appearance and corrosion resistance, in smoothing the metallic surface by removing certain contaminants and in enhancing the continuity of the anodic coatings on aluminum alloys (see 3.3.3). The percentage of reflectivity obtained from a part which has been electrolytically brightened and subsequently anodized will depend on the alloy and the coating thickness. Certain alloys are more capable of obtaining a highly brightened surface and thicker anodic coatings will reduce reflectivity.

6.10 Design information.

6.10.1 Surface dimension of parts. On specifying the thickness of coatings, especially for the Type III coatings, allowance must be made for dimensional increase. Both a machining dimension and a coated dimension should be placed on applicable drawings. An increase in dimension, equal to one half of the thickness of the applied coating, can be expected for each surface coated due to surface growth. For example, for a 0.004 inch (4 mils) coating on close tolerance parts, a pre-machining allowance of 0.002 inch (2 mils) per surface must be made prior to hard coating. If close fits are specified in design drawings, buildup in thickness caused by anodic coatings, especially Type III, may result in interference on assembly.

6.10.1.1 Holes. In the case of small holes and tapped holes, coating thickness can vary from no film to a full normal coating. Holes, both tapped and not tapped, over 1/4 inch should be anodized. Parts with Type II coatings, external or internal, with a total tolerance of 0.0004 inch or less, if lapped, honed or stoned to size after anodizing, should be subsequently treated with QPL-81706 materials to provide surface protection. Discoloration on the surface that has been sized is acceptable (see 6.6). The designer is cautioned to require adequate thread and hole sealing operations in subsequent assemblies as may be required to produce the necessary corrosion resistance.

6.10.2 Thread dimensions. All anodic coatings will affect thread dimensions for external and internal threads; the major and minor diameter will be increased 2 times the amount of growth (see 6.10.1). The pitch diameter for threads having an included angle of 60° will increase 4 times the amount of growth. For threads having an included angle, other than 60°, the pitch diameter will increase 2 times the amount of growth (see 6.10.1) divided by the sine of 1/2 the included angle.

6.10.3 Fabrication. Successful use of anodic coatings, especially the hard Type III, depends on proper product design. Because of the manner of formation, anodic coatings will develop voids at sharp corners and edges. Sharp edges and corners are difficult to anodize satisfactorily and in general should be avoided. All edges and inside corners should be radiused prior to anodizing. Chamfering should not be used unless resulting sharp edges are radiused. In general, to avoid any uncoated edges or inside corners, the piercing and blanking operations should comply with the radii of curvature for nominal coating thicknesses as in Table III.

TABLE III. Radii of curvature for nominal coating thickness.

Nominal coating thickness, inch	Radius of curvature (edge and inside corner)
0.001	approximately 1/32 inch
0.002	approximately 1/16 inch
0.003	approximately 3/32 inch
0.004	approximately 1/8 inch

6.10.4 Coating thickness. Thickness of the heavy Type III coating can be controlled to extremely close tolerances. Anodized coating can be obtained with tolerances of as little as ± 0.0001 inch (0.1 mil). With all anodizing processes used primarily for engineering rather than for decorative purposes, a number of highly specialized techniques are used for operation control. One method that may be employed is to carefully measure the coated part while still wet and replace it in the bath for a fixed period of treatment. Calculations based upon a calculated rate of coating per unit of processing time may be used as the basis for determining the exact duration of processing required for the specific alloy being coated.

6.10.5 Coating dimensions. Table IV gives typical thickness ranges of anodic coatings that can be applied on aluminum and aluminum alloys. All anodic coatings are harder than the substrate material. If interference is required for assembly, and is accomplished by force fitting, Type I, IB, IC, IIB, and some Type II coatings are too thin and too brittle to withstand abrasive damage during such assembly. With Type III coatings assembly may be accomplished by grinding, lapping or otherwise removing the surplus coating. All anodic coatings are brittle and may crack and spall due to force fittings.

TABLE IV. Thickness ranges of anodic coatings on aluminum and aluminum alloys.

Coating Type	Thickness range, inch
I, IB, IC, and IIB	0.00002 to 0.0007
II	0.00007 to 0.0010
III	0.0005 to 0.0045

6.10.6 Coating thickness. Table V gives typical minimum thicknesses in inches of anodic coatings formed on some wrought and cast alloys that could comply with the minimum coating weight requirements in accordance with Table I for Types I, IA and II, Class 1.

TABLE V. Minimum thickness (typical) in inch of anodic coatings.

Alloy designation	Thickness of coating, inch	
	Type I, IB, and IC	Type II
1100	0.000029	0.000093
2024-T4	-	0.000125
2024-T6	0.000044	-
3003	0.000035	0.000103
5052	0.000033	0.000098
5056	0.000021	-
6061-T6	0.000034	0.000099
7075-T6	0.000040	-
Alclad 2014-T6	0.000045	-
Alclad 7075-T6	0.000041	-
295-T6	-	0.000107
356-T6	-	0.000102
514	-	0.000086

6.10.7 Effect on fatigue. The fatigue properties of aluminum alloys can be severely reduced by anodic coatings. The amount of reduction varies with the process. As a general rule, the thicker the coating the greater the reduction in fatigue will be.

6.11 Duplex sealing. The corrosion resistance of dyed parts, especially those anodized in a sulfuric acid bath, Type II and IIB, may be enhanced by treatment in a sodium dichromate solution either during or after conventional sealing with nickel acetate. This treatment can cause slight changes in the color of the dye. Paint systems adhere very satisfactorily to duplex sealed dyed coatings. However, where any objection with such duplex sealing application is warranted because of a firmly desired coloration, the dual process for sealing should not be used.

6.12 Dyeing or coloring Type I, IB, IC, and IIB coatings. Type I, IB, and IC coatings have a different pore structure and along with Type IIB coatings are thinner than Type II coatings which makes them more difficult to dye. As a result, Type I, IB, IC, and IIB black anodized may not readily obtainable.

6.13 Alloys having 2 percent or more copper content. Aluminum alloys having a nominal copper content of 2 percent or higher include all 2xxx series alloys, 7050 and 7178 (see 3.7.2.2).

6.14 Size of contact marks. In order to obtain the desired current density without burning the parts, the size or number of contact marks will be greater on parts having higher surface areas. Because current density is a measure of the required current per square foot of aluminum being anodized, a part having twice as much surface area relative to another will require twice as much current. Trying to force the higher currents required for larger parts through smaller contact areas sufficient for parts with lower surface areas may result in burning.

6.15 Sealing. The hot deionized water seal is advantages from an environmental viewpoint. In addition, The use of a hot deionized water seal on Type I and IB coatings yields good corrosion resistance and may eliminate the appearance of patchy dark gray areas after salt spray exposure (see 6.18 and 3.7.1.2).

6.16 Effects on coating thickness. A hardcoat of 2 mils or more is extremely difficult to obtain on high silicone die castings such as 360, 380, and 383. It is recommended that this be considered when specifying a coating thickness for high silicone castings.

6.17 Effects of Type III coating thickness on abrasion resistance. The abrasion resistance of Type III coatings will decrease as the coating thickness approaches 3 mils. In general, the abrasion resistance does not increase with increasing coating thickness.

6.18 Corrosion resistance of Type I and IB coatings. Although pitting may not be visually evident with the unaided eye, the appearance of dark gray areas on the surface after salt spray exposure is an indication of coating degradation.

6.19 Definition of a pit. A pit is defined as an area of localized corrosion having a depth greater than its width. As a general rule, a pit usually displays a characteristic tail or line (see 3.7.1.2).

6.20 Acceptance criteria. Previous revisions of this document specified an Acceptable Quality Level (AQL) of 1.5 percent defective.

6.21 Supersedure data. Type I, conventional chromic acid anodizing, referenced throughout this specification is the same as the Type IA designated in the D revision and the Type I in all versions preceding the D revision.

6.22 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

6.23 Subject term (key word) listing.

- Aluminum
- Aluminum alloys
- Anodic coatings
- Anodizing
- Chromates
- Chromic Acid
- Potassium Dichromate
- Sodium Dichromate

Custodian:

- Army - MR
- Navy - AS
- Air Force - 11

Preparing activity:

- Navy - AS
- (Project no. MFFP-0493)

Review activities:

- Army - AR, AV, MI
- Navy - OS, SH
- Air Force - 70, 71, 80, 82, 85, 99

User activities:

- Army - AT, CR, ME

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:		1. DOCUMENT NUMBER MTI-A-8625F	2. DOCUMENT DATE (YYMMDD) 93/09/10
3. DOCUMENT TITLE ANODIC COATINGS FOR ALUMINIUM AND ALUMINUM ALLOYS			
4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)			
5. REASON FOR RECOMMENDATION			
6. SUBMITTER			
a. NAME (Last, First, Middle Initial)		b. ORGANIZATION	
c. ADDRESS (Include Zip Code)		d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (If applicable)	7. DATE SUBMITTED (YYMMDD)
8. PREPARING ACTIVITY			
a. NAME COMMANDING OFFICER, NAVAL AIR WARFARE CENTER AIRCRAFT DIVISION LAKEHURST SYSTEMS REQUIREMENTS DEPARTMENT		b. TELEPHONE (Include Area Code) (1) Commercial (908) 323-7488	(2) AUTOVON 624-7488
c. ADDRESS (Include Zip Code) CODE SR3 LAKEHURST, NJ 08733-5100		IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340	

Ted Burgoin

From: "Oucharek, Gregory" <OUCHARG@tc.gc.ca>
To: "Ted" <ted@aerodesign.ca>
Cc: <richard@aerodesign.ca>
Sent: Thursday, June 19, 2008 1:56 PM
Attach: Conformity Inspection Record.pdf
Subject: RE: 212/205 Rappel Provision and Cargo Deployment Arm *** Conformity Inspection / Dwg Review ***

Ted,

Attached is the completed B-043 Conformity Inspection Record. Non-conformance items corrected by DCN and otherwise noted are acceptable.

I did a quick drawing review on this package and have a few points that need to be addressed prior to issuance of the STC:

- 1 • Drawing finish notes are too general. Alodine type (1000 or 1200?) as well as the primer/enamel need to be specified and applied in accordance with a process spec. This is an old item, and if I recall correctly from past STCs, you (a.k.a. Jeff) developed a company standard for this;
- 2 • On machined parts (plate and bar specifically), grain direction L - LT need to be specified. Design allowables are different in the respective directions and should be checked against the supporting analysis;
- 3 • As discussed onsite, a thorough review/check of fits and tolerances needs to be completed. In addition to the Cargo Arm Bushing example we discussed, drawing 79835 allows +/- .03 on both the bushing diameter as well as the length, not sure this will accomplish the intended function with this degree of allowed variability (typically 0.10% - 0.20% interference is expected). Especially important in the cargo arm as the sustained tension stress will make the carbineer lug susceptible to stress corrosion cracking;
- 4 • A thorough review/check of dimensioning needs to be completed. For example, I could not locate the position of 0.2130 & 0.375 holes in the plan view of drawing 79833;
- 5 • Do you have an idea of acceptable surface roughness for the machined parts ... Ra 63, 125?

I understand for the LSTC that the parts are what they are. However for the STC, where the production of vast quantities of Rappel / Cargo Deployment systems are possible, the drawings need to be un-ambiguous and repeatable. A methodical check will address most of the above points.

I am happy to discuss further if necessary.

Greg

-----Original Message-----

From: Oucharek, Gregory
Sent: Wednesday, June 18, 2008 8:54 AM
To: 'Ted'
Cc: richard@aerodesign.ca
Subject: RE: 212/205 Rappel Provision and Cargo Deployment Arm

Good idea.

Malcolm and I have a window tomorrow morning ... I will firm up a time shortly.

Will need a signed B-043 form that includes all relevant drawings and indication of any non-conformance sent to me today.

11/18/2008

I will call and follow-up later this morning.

Greg

-----Original Message-----

From: Ted [mailto:ted@aerodesign.ca]

Sent: Tuesday, June 17, 2008 4:48 PM

To: Oucharek, Gregory

Cc: richard@aerodesign.ca

Subject: 212/205 Rappel Provision and Cargo Deployment Arm

Greg:

Want to proceed with application for an STC for this installation.

There has been interest from BC forestry and at least some interest from Alberta as well.

Have an assembled unit that conforms to drawings that will be shipped to Alpine shortly but is available for you to have a look at if interested and/or getting a conformity inspection done while it is still in Calgary and in my control.

I realize this is a bit out of sequence as we haven't made the application yet but the opportunity to make it easy is available with a limited window at present.

Give me your thoughts.

Ted.

11/18/2008